Standard Size, 9 x 12. DECEMBER 29, 1898. Price, Six Cents.

AMERICAN MACHINIST

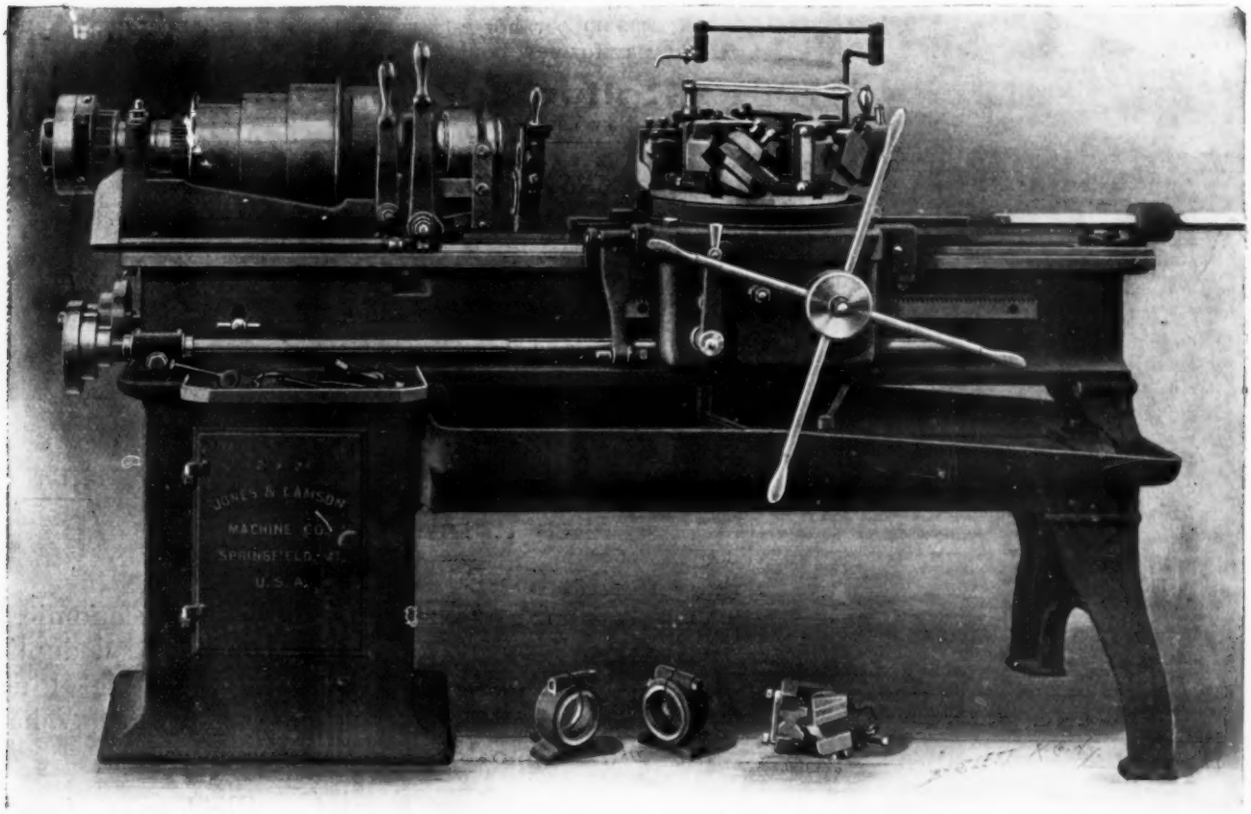
A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

ISSUED WEEKLY BY THE AMERICAN MACHINIST PUB. CO.,

Vol. 21. 218 WILLIAM STREET, NEW YORK. No. 52.

CONTENTS AND INDEX TO ADVERTISERS, PAGE 9.

Begin the new year with a 2x24 Flat Turret Lathe in your shop. It has helped to pay dividends in over a thousand shops this year. Give it a chance to reduce the cost of *your* lathe work for 1899.



Jones & Lamson Machine Co.,

Springfield, Vermont, U. S. A.,

and

English Offices: Jones & Lamson Machine Co., 6 Exchange Building, Stephenson's Place, Birmingham; Henry Kelley & Co., 26 Pall Mall, Manchester.

Office for Germany, Holland, Belgium, Switzerland, Austria-Hungary and Italy: M. Koyemann, Charlottenstr., 112, Dusseldorf, Germany.

Steam Hammers

take steam above and below piston. Rams and guides are set diagonally to the frame at the proper angle for drawing and finishing. Valves are perfectly balanced, easily handled and of great durability. Valve gear is simple and substantial. Takes up its own lost motion and operates either automatically or by hand, producing every desired variation in length, position, rapidity and force of blow. Other features we shall be pleased to acquaint you with.

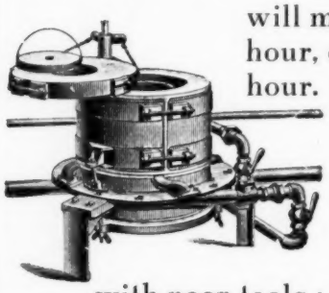
Bement, Miles & Co.,

Philadelphia, Pa.

39 Cortlandt Street, New York.
1534 Marquette Building, Chicago.

Foreign Agents:
C. W. Burton, Griffiths & Co., London.
Schuchardt & Schutte, Berlin, Vienna and Brussels.
Fenwick Freres & Co., Paris.
E. Hirsh & Co., Stockholm.

This Gas Furnace



will melt 45 lbs. of metal at 15 cents per hour, or 300 lbs. at a cost of 50 cents per hour. Just compare this expense with the expense of doing it the old way; then remember all the trouble you had in the old way. You cannot get a maximum quantity of work out of a man with poor tools; it's no use to try. Particulars ready.

American Gas Furnace Co.,

23 John Street, New York.

Chas. Churchill & Co., London. Schuchardt & Schutte, Berlin and Vienna. Hermann Glaenzer & Co., Paris.

If you use 100 horse-power and lose 35 horse-power in friction, and flexible roller bearings will save 25 per cent. of this amount, the saving at $35.00 per horse-power will be over $300 per annum and more than pay for new boxes.

Hyatt Roller Bearing Co., Harrison, N. J.

133 Liberty Street, New York.

Henderer Jacks, Punches and Expanders

are the best tools of their respective kinds made. Designed by practical men in a practical manner, from the best of materials. Reading matter ready.

A. L. Henderer's Sons,

85 Maryland Avenue, Wilmington, Del., U. S. A.

A. W. Secor, Agent, 123 Liberty Street, New York.

No man makes a mistake

when he specifies Bullard Tools.

Bullard Tools are for the rapid and economical handling of bored, faced, turned or threaded duplicate work in metal. Were designed for that kind of work especially, and are money makers. What would you like to know about them?

The Bullard Machine Tool Co., Bridgeport, Conn.

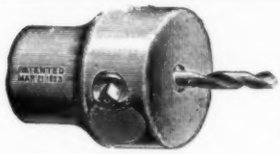
Chas. Churchill & Co., London. Schuchardt & Schutte, Berlin, Vienna, Brussels. Ad. Janssens, Paris.

Turret Lathes.

We make a Turret Lathe—call it No. 2 Cabinet Turret Lathe. It's a good lathe, has features that make it better than most turret lathes, is very compact and firm, no chance for spring or chatter; is so arranged that centers "agree"—that means that your work is bound to be accurate. A man with common, everyday horse sense can keep a lathe like this always right. Like all of our tools, no lathe of this kind ever left our shop until it was just exactly right—right in material, right in workmanship, right in price, always right—wouldn't let anything else through our doors; that's the way we made our reputation as builders of good tools.

American Tool & Machine Co., Boston, Mass.

Founded 1845. Incorporated 1864.



Style B—Two-Jaw.

Or CHAS. CHURCHILL & CO., Ltd., London and Birmingham, Eng.

Ask your nearest Dealer, or send to the Manufacturers for

THE LATEST

IMPROVED DRILL CHUCKS,

Strong, Accurate, Durable, Cheap.

THE E. HORTON & SON CO.,

WINDSOR LOCKS, CONN., U. S. A.

AWARDS AT THE WORLD'S FAIR.

"Cushman" Chucks.

We manufacture ten distinct styles of Lathe Chucks, four styles of Drill Chucks, Centering Chucks, Face Plate Jaws and Chucks for special service. Send for new catalogue and discount sheet.

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Hartford, Conn., U. S. A.

Skinner "New Model"

Drill Chucks can be taken apart, cleaned and oiled with ease. A screwdriver is the only necessary tool. Have you had experience with THE OTHER KIND? Write for prices, and illustrated catalog—Free.

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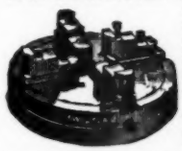
LATHE CENTER GRINDERS.

TRUMP BROS. MACHINE CO.,
MANUFACTURERS,
WILMINGTON, DEL., U. S. A.

Sweetland Chucks



Of All Descriptions. Combination and Universal, with Patent Reversible Jaws. Independent Chucks, Geared Scroll Chucks, Face Plate Jaws, Machinists' Tools. Send for Catalog.

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AUTOMATIC MACHINES

FOR MAKING

Stove Bolts, Tire Bolts, Rivets, Lag Screws and Wood Screws.

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When a concern

has been making good Drill Chucks for forty years they've found out a lot of things that some of the more recent chuck makers have got to learn. Whiton started making chucks over forty years ago. Whiton knows about chucks—any kind.

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Sole European Agents—Selig, Sonnenthal & Co.
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Pratt's Positive Drive Drill Chuck.

A No. 1 Jaw Chuck with Positive Drive extra.

Pratt Chuck Co.,
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CUTTING OFF MACHINES, the Latest and Best.

HURLBUT ROGERS MACHINE CO.,
SO. SUDBURY, MASS.

German Agents: Schuchardt & Schutte, Berlin and Vienna.

English Agents: Chas. Churchill & Co., Ltd. London and Birmingham

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Self-Opening and Adjustable.

The only mechanically correct automatic Die Head on the market. All leverage entirely overcome. Makes a full and perfect thread in one cut, and besides it can be accurately adjusted. Saves 50 per cent. in time and wear over solid dies. Made for cutting from No. 17 wire gauge to 6 in. diameter, and arranged for any style of thread. Adopted by all principal manufacturers of bicycles and bicycle fittings throughout the country. WHY? Write us for particulars and prices.

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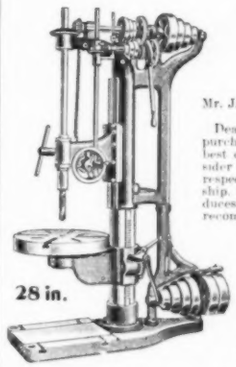

28 in.

New 28 in. Drill Press.

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Mr. J. E. SNYDER, Worcester, Mass:

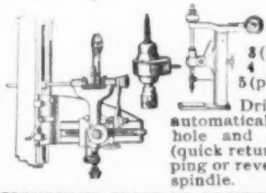
Dear Sir—The 28 inch Drill purchased of you is giving the best of satisfaction, and we consider it a first-class tool in every respect, both in design, workmanship, and quality of work it produces, and we take pleasure in recommending it to the trade.

Yours very truly,
L. W. POND MACHINE COMPANY.

J. E. SNYDER,
Worcester, Mass., U. S. A.
New Catalogue free.

Errington Tapping Chuck.

The ONLY Automatic Reverse.
No Backing Belt.
No Special Taps.
No Extras.
Fits Socket of ANY Drill Press.
Either Friction or Positive Tool Holder.



No. 0 taps 1/8 to 3/16
1 taps 1/4 to 5/16.
2 taps 3/8 to 1/2.
3 (pipe) taps 1/4 to 1/2.
4 taps 3/8 to 13/16.
5 (pipe) taps 1/4 to 1 1/4.

Drives tap in, stops automatically at bottom of hole and backs tap out (quick return) without stopping or reversing drill press spindle.

ERRINGTON FRICTION-GRAVITY SLIP CHUCK.

Tools changed and friction adjusted while spindle is rotating without danger to operator.

Tools connected by pressure against work; disconnected by gravity, yet supported in spindle.

Errington Automatic-Reverse Drill Press Turret.

fills the hole, taps it and then sets the stud in all **without stopping or reversing drill press and without moving work.**

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Successor to C. W. LeCount,
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Ask for Cat. A., Machine Tools.
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The Reid Drill Chuck.

The anti-drill slip chuck.

R. H. Brown & Co.,
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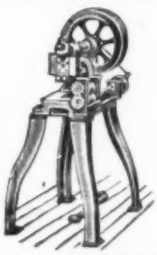
The TOLEDO MACHINE & TOOL CO.



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MANUFACTURERS OF
Power Punching, Drop, Trimming, Stamping, Riveting and Embossing Presses for Working Bar and Sheet Metals.

Complete outfits for Bicycle Stampings, Can Making, Etc.
Send for 1897 Catalogue, just out.

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Pacific Coast Agent—V. J. A. Rey, San Francisco, Cal.

DIXON'S TRACTION BELT DRESSING.

It absolutely prevents a belt from slipping. Thoroughly preserves the leather and protects the elasticity of the belt. Warranted to give satisfaction. It will pay you to send for our circulars and prices.

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Emery and Corundum Wheels and Grinding Machinery. Emery and Corundum in Bulk.

Hampden Corundum Wheel Co., Write for Circular C. BRIGHTWOOD, MASS.

Machinery

for reducing and pointing wire. Specially adapted to pointing wire rods and wire for drawing.

For machines or information address the manufacturer,

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Dust-Proof Oil-Hole Covers.

9 SIZES.

A substitute for loose plugs. Over one million in use.

Adopted by many of the leading machinery builders.

F. D. WINKLEY, 534 Francis St., Madison, Wis.

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No. 2.

Armstrong's Pipe Threading and Cutting-off Machines.

No. O Machine.

Both Hand and Power. Sizes 1-8 to 6 in.

Our Stocks and Dies universally acknowledged to be THE BEST.

Send for Catalog.

The Armstrong Mfg. Co., Bridgeport, Conn. 139 Centre St., New York.

We want you to try our

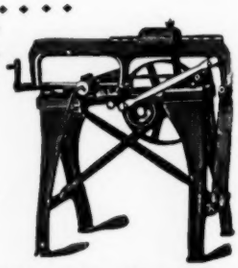
Rapid Printing

BLUE PRINT PAPER.

Our new solution is the finest and quickest yet and gives white lines. Send for samples and prices.

THE MACKEY CO., Ltd., PITTSBURG, PA.

Stover Power Hack Saw.



Saws made in two sizes, Nos. 1 and 2. Cut 4½ in. to 8 in.

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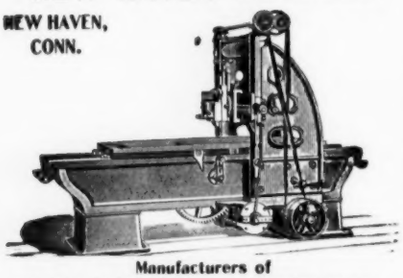
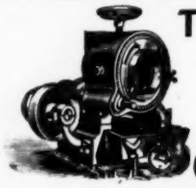
NEW HAVEN MFG. CO.

NEW HAVEN, CONN.



Manufacturers of

IRON WORKING MACHINERY.



The Forbes Patent Die Stocks.

FOR HAND OR POWER.

10-inch pipe cut off, or threaded by hand with ease.

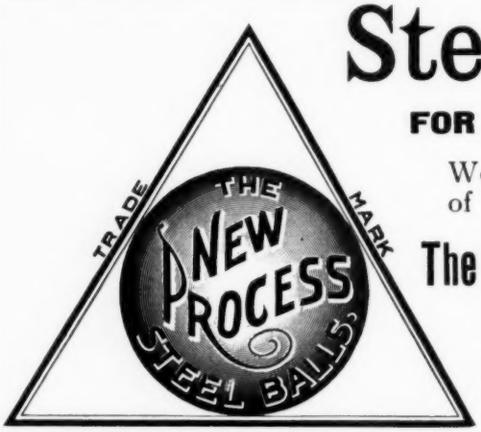
Send for Illustrated Catalogue.

Curtis & Curtis, 66 Garden Street, Bridgeport, Conn

Steel Balls

FOR ALL PURPOSES.

We are the largest producers of Steel Balls in existence.



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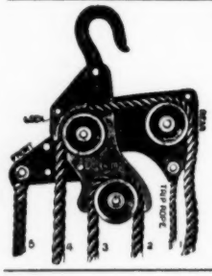
COLBURN KEYSEATERS

Cut perfect keyways. No need to face the hubs, work chucked in the bore. Send for catalogue.

BAKER BROTHERS, Westlake Ave., Toledo, O.



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Want the Best Lift Made?

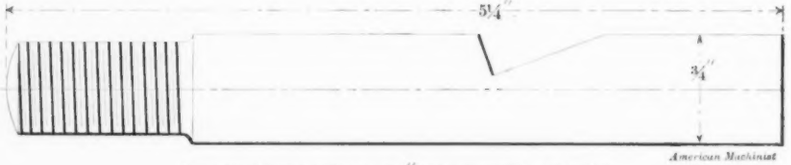
Then you want to buy

THE BURR STEEL SAFETY LIFT.

It works at any angle, and is the only rope block made that will do the same work as the differential chain block. Ask your dealer for it; if he does not have it write to

THE BURR MANUFACTURING COMPANY, 823 Society for Savings Building, CLEVELAND, OHIO, U. S. A.

The only way to finish work



Hardened steel finished .005" stock removed 5 minutes

of this kind properly is to do it on a Landis Grinder. The reasons why are to be found in our catalogue, which is quite a good sized book, and which will be sent free to interested people.

Landis Tool Co., Waynesboro, Pa., U. S. A.

Hill, Clarke & Co., Boston and Chicago. Walter H. Foster, Manager, New York.
C. W. Burton, Griffiths & Co., London.
Ad. Janssens, Paris.
Schuchardt & Schutte, Berlin and Vienna.

The Woolley Drop Hammer

cannot be excelled in action, design or construction.

Woolley Foundry & Machine Works, P. O. Box 100, ANDERSON, INDIANA, U. S. A.

LATHES, PUNCHES and SHEARS. { GET OUR PRICES. } W. C. YOUNG MFG. CO., Worcester, Mass., U. S. A.

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Builders of

Power and Foot Presses

for blanking, cupping, drawing, sub-pressing and embossing sheet metal.

Rolling Mills

for flattening wire.

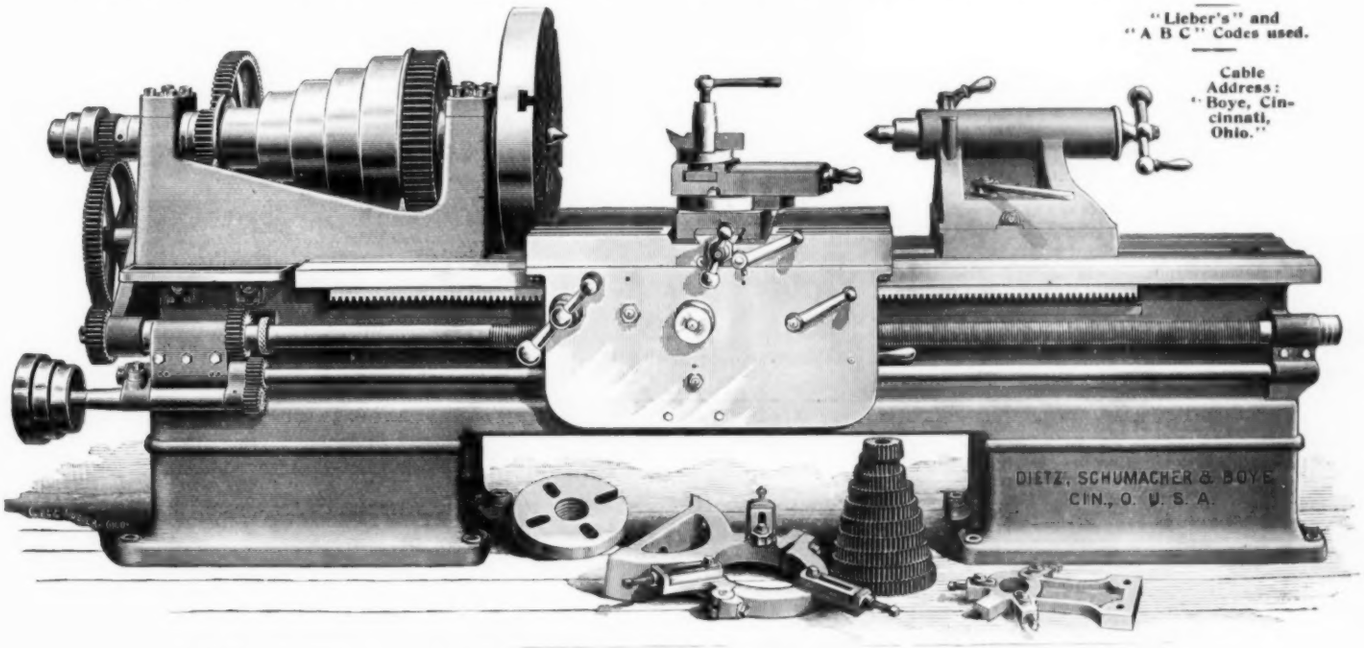
Automatic Wire Forming Machines

that take wire from the coil and form same into various shapes that may be required.

WATERBURY, CONN.

14, 16, 18, 22, 24, 26 and 28 inch Engine Lathes.

Several good, practical, new features. Carriage can be firmly locked while cross feed is at work by a simple eccentric clamp. Cross feed can be engaged or disengaged by simply pushing a button. Special mechanism for regulating tension of feed belt. They are simple, massive and convenient throughout. Compound Rests and Tailstocks of American or European designs.



"Lieber's" and "A B C" Codes used.

Cable Address: "Boye, Cincinnati, Ohio."

DIETZ, SCHUMACHER & BOYE,

Queen City Avenue and Buck Street, CINCINNATI, OHIO.

GRINDING AND POLISHING MACHINERY.

Our cable address is "BUILDERS, PROVIDENCE." We use the A B C and Lieber's codes, and have in stock, ready for immediate shipment, all the machines and countershafts listed in our catalogue.

Catalogue mailed upon application. Discounts furnished upon application to us or to leading Machinery and Supply Dealers throughout the country, and to Charles Churchill & Co., Ltd., London, England; Fenwick Freres & Co., Paris, France, and Schuchardt & Schutte, Berlin, Germany.

BUILDERS IRON FOUNDRY,
FOUNDERS AND MACHINISTS,
PROVIDENCE, R. I.

MOFFET PORTABLE DRILL.

UNSURPASSED AS A REAMER.

Will work in any position.

Weighs 48 lbs. and drills from ½ to 2¼ inches diameter.

Runs with Steam or Compressed Air.

Send for Circular.

Manufactured by
J. G. Timolat.
465-467 W. Broadway
NEW YORK.

New 26 in. Drill
WITH
ADJUSTABLE HEAD.

A Powerful Machine.
Nicely Balanced.
Quickly Adjusted.

Screw Device operates Table. With or without Back Gears. Self-Feed. Reverse Motion or Automatic Stop.

IT'S A LABOR SAVER.

Drill Book "C" tells you all about it.

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South Bend, Ind.

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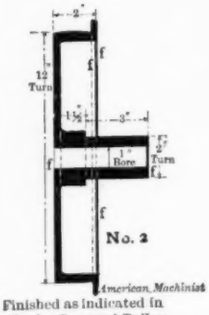
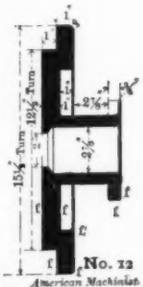
HOT FORGED, FOUR GROOVED CHUCKING REAMERS
are tougher, stronger and work better. Try one. Made only by
NEW PROCESS TWIST DRILL CO., TAUNTON, MASS., U. S. A.
Manufacturers of Twist Drills of every variety. Catalog.



Finished as indicated in 42 min. Crowned Pulley

If you are going to handle duplicate work

why not do it right? The right way is not by using a common lathe. A common lathe is a waster of time, material and money. There's one successful, money making way of producing duplicate work having to be bored, turned, faced, or threaded, and that's by using the Gisholt Turret Lathe. Samples of Gisholt work are shown here, with the time it took to make. Book free.

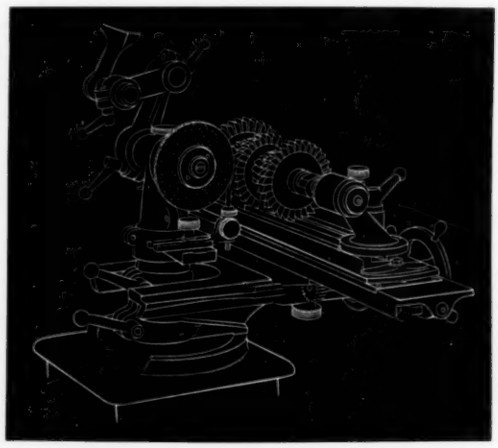


Finished as indicated in 55 min. This is an average of 3 pieces, and includes setting tools.

Gisholt Machine Co.,
Madison, Wis., U. S. A.

Eastern Branch, 126 Liberty St., New York; Walter H. Foster, Manager.
U. Baird Machinery Co., Pittsburg, Pa.
C. W. Burton, Griffiths & Co., 1, 2, 3 and 4 Ludgate Sq., London, E. C., Eng.
Fenwick Freres & Co., 21 Rue Martel, Paris, France.
Schuchardt & Schütte, Spandauer-Strasse 59-61, Berlin, C., Germany.
Schuchardt & Schütte, Breitgasse 17, Vienna, VII., Austria.

The WALKER UNIVERSAL TOOL and CUTTER GRINDER



Sharpening a gang of cutters without removing same from arbor.

Send for complete Illustrated Catalogue.

Norton Emery Wheel Co.
WORCESTER, MASS.

THE BECKER VERTICAL MILLING MACHINES
Built ONLY by
John Becker Mfg. Co.
Fitchburg, Mass.

Drop us a line if you are unacquainted with them.

J. W. Cregar, The Bourse, Philadelphia, Pa. U. Baird Machinery Co., Pittsburg. Hill, Clarke & Co., Chicago.
Selig, Sonnenthal & Co., London. Schuchardt & Schutte, Berlin, Vienna and Brussels. Roux Freres & Co., Paris.

Mechanical and Electrical Books.
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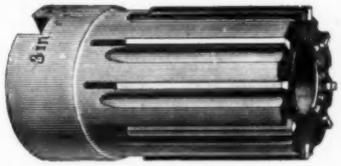
SOLID ADJUSTABLE REAMERS.

Patent Planer and Surface Gauge.



Corrective Gauge Standards.

For testing and correcting fixed gauges, for setting calipers, and also as a reference to prove dimensions within their range. Each disc is separate and is ground independently to size.

Fixed Caliper Gauges.

LIMIT GAUGES.

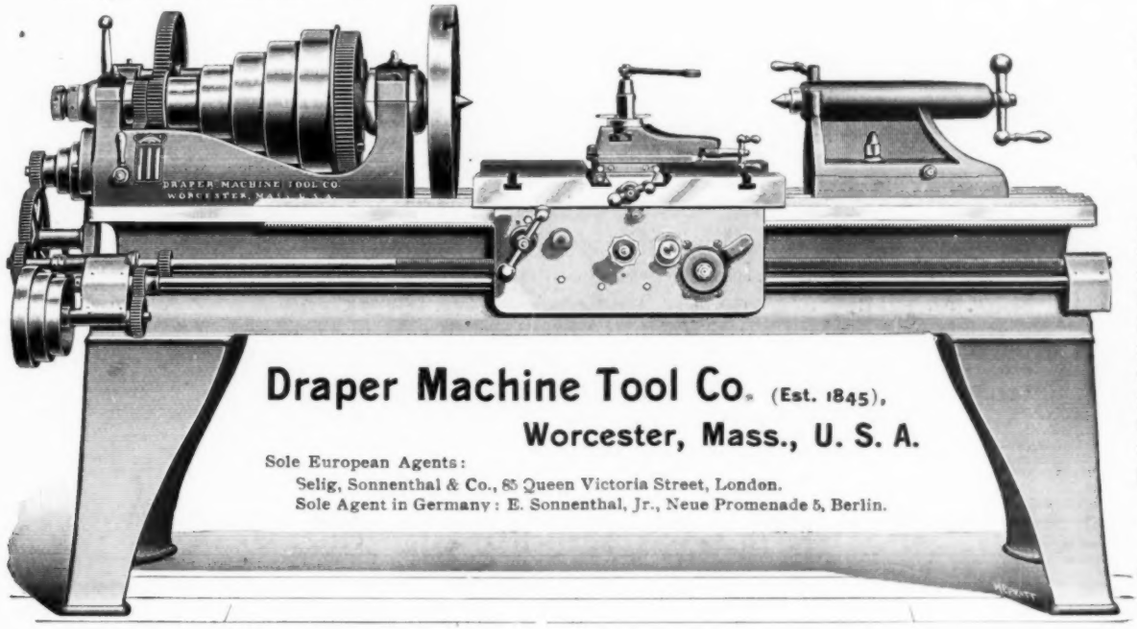
The John M. Rogers, Boat, Gauge & Drill Works,

Gloucester City, New Jersey, U. S. A.

18-inch Swing Screw-Cutting Engine Lathe

with Compound Power Cross Feed Rest.

Features: Five-step cone rod feed; power feed to compound rest; hollow spindles; slip pinion on feed-rod doubles range of feed; rack gear disengaged when nut-lock is engaged. Impossible to engage more than one feed at once. Send for new Catalogue B, showing our full line of improved tools, honestly made for heavy service and lots of it.



Plain gib rest, raise and fall rest and taper attachment furnished as desired.

Draper tools are strong and rigid, have large bearings and are first-class in every respect, and sold at a reasonable price.

Prompt deliveries, etc.

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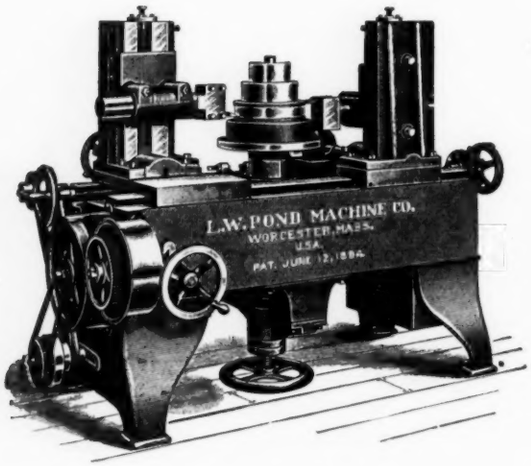

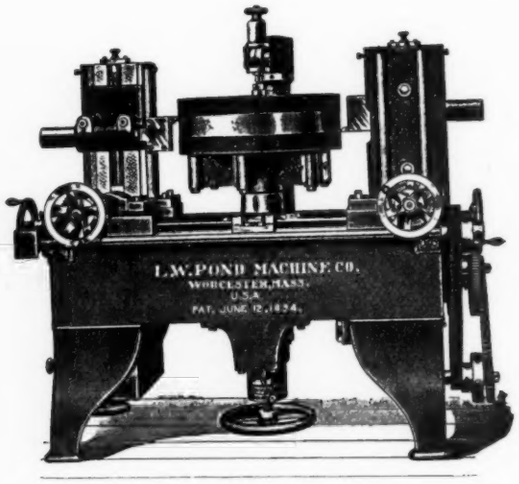

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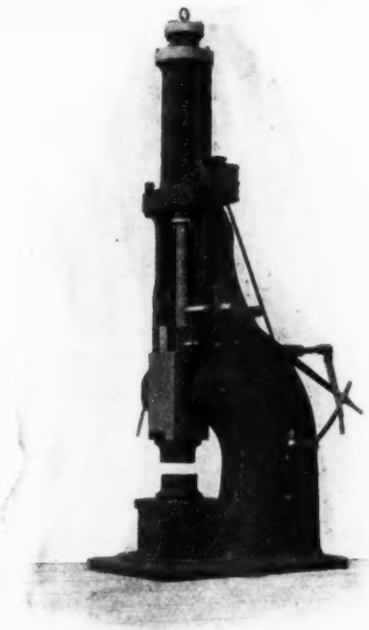

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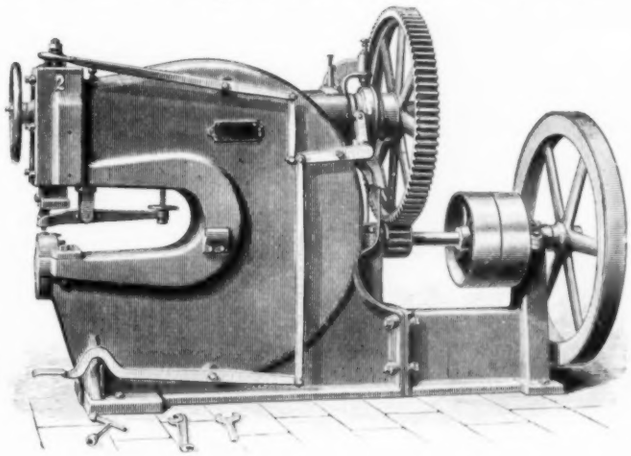

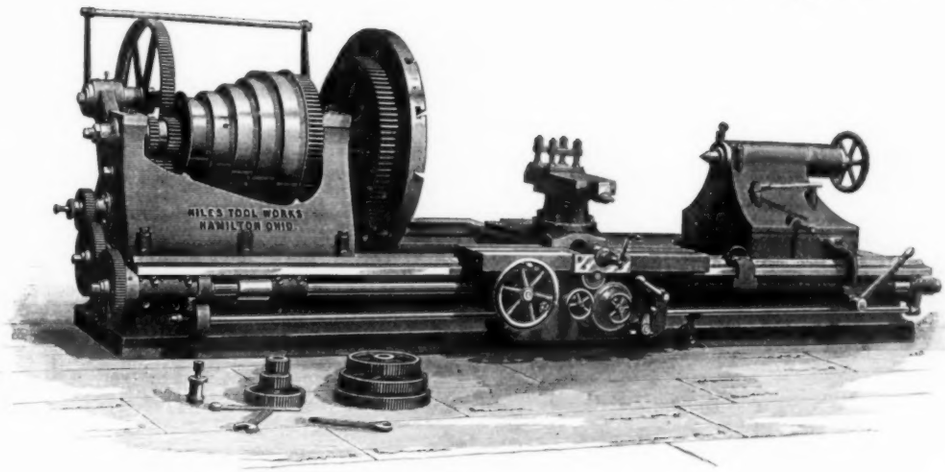

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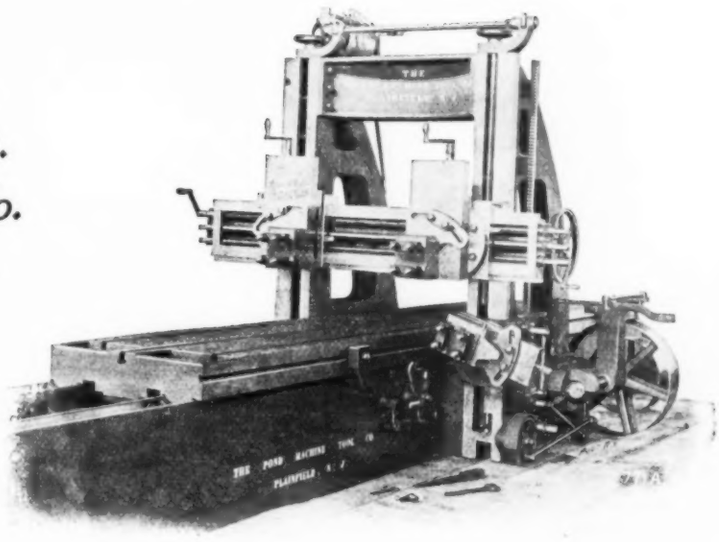

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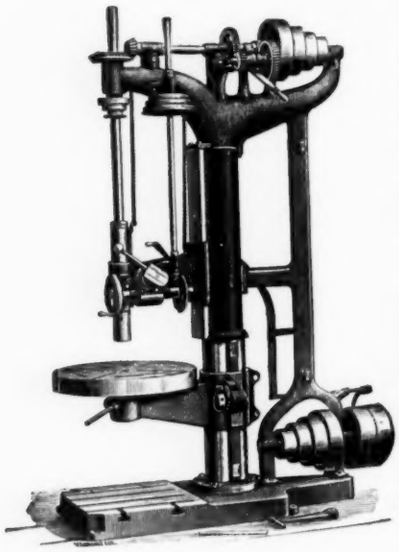

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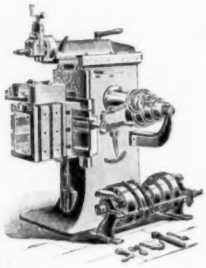

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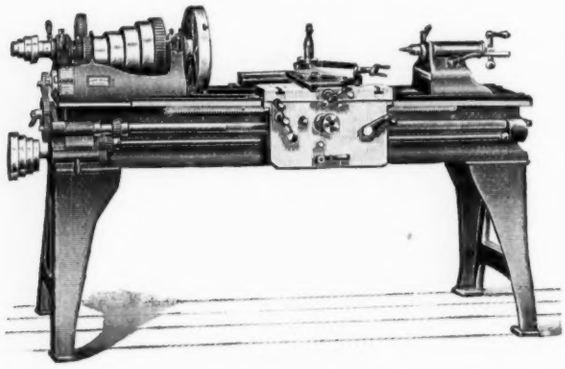

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To correct an impression that the Export Editions of the American Machinist are to be printed in English, German and Spanish throughout,

would say that only the portion of the edition coming under the heading of machinery other than machine tools will be so treated.

The primary object of these editions is to catalogue the makers of machinery outside of machine tools; we mean by other than machine tools, machinery for the manufacture of hats, shoes, cloth, sugar, toothpicks or machinery of any kind except machine tools.

There will be plenty of room in the regular portions of the paper, in which the maker of machine tools can have as much space as he desires. We think that larger space in these editions will be money well spent.

These editions will be widely distributed into the hands of buyers of all classes of machinery, and we feel sure that a larger space in the regular portion of the paper will be to the advantage of the machine tool builder; and if the use of other languages is desired, we will set the advertisement in such languages at an extra cost of $5.00 for each language; this to cover cost of translation and composition. We do not believe, however, that the use of these other languages in the advertising of machine tools will be of any special value. Certainly not in Spanish.

The Export portion of the paper is for lines outside of machine tools and is the only portion which will be printed in the three languages, with the exception as before noted; that is, a machine tool builder can have his advertisement printed in three languages in the regular portion of the paper at an additional cost to him of $5.00 for each language he uses, and if such translations are desired, copy should be sent us at once in order to have the translations made and the advertisement set.

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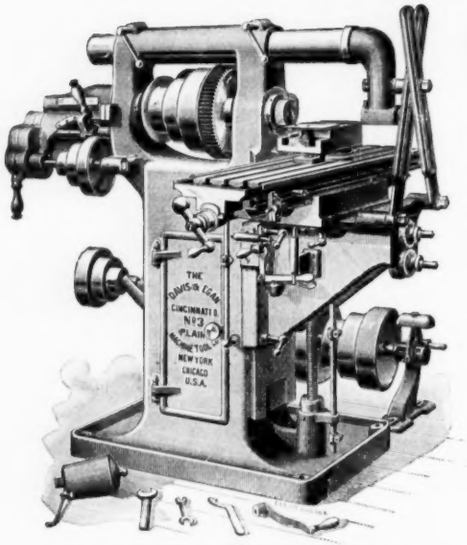

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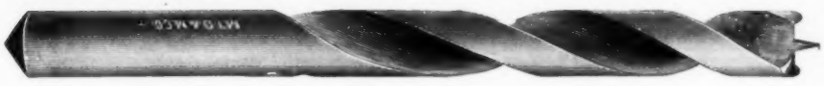

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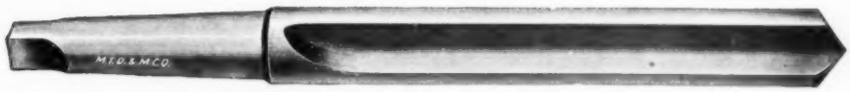

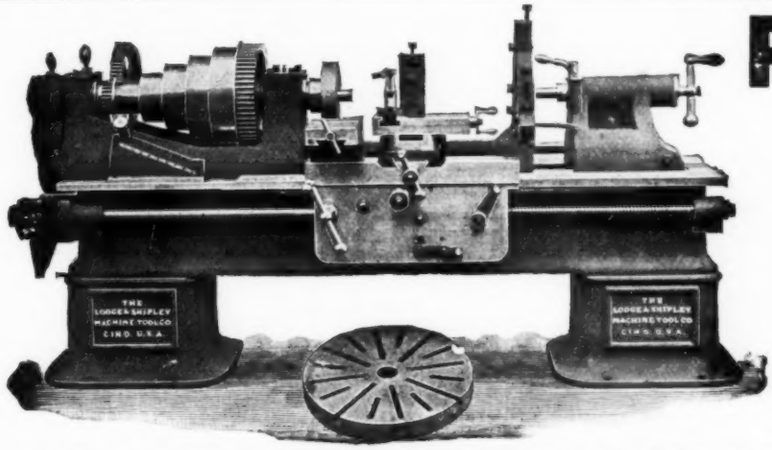

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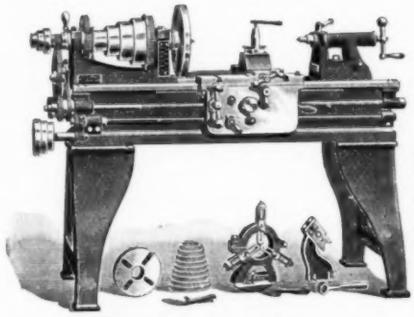

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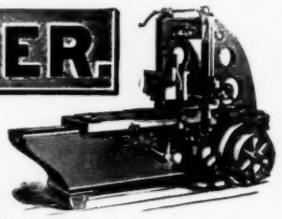

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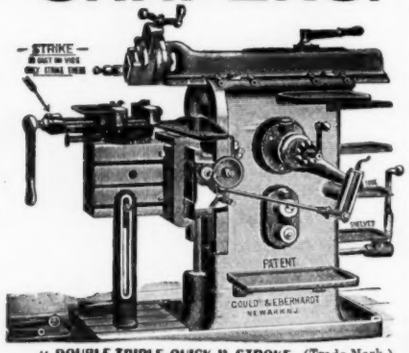

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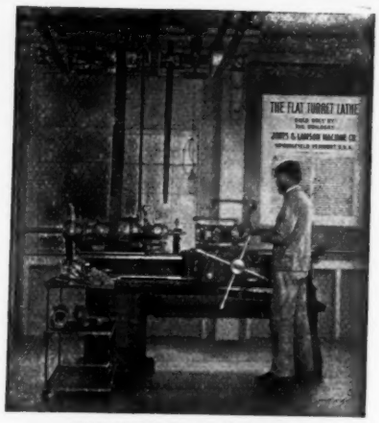

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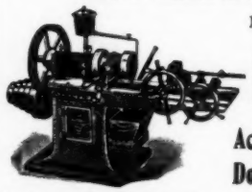

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VOLUME 21. NEW YORK, THURSDAY, DECEMBER 29, 1898. NUMBER 52.

▲ ▲ ▲

The Manufacture of Shell for the United States Navy.

BY RUDOLPH E. BRUCKNER, M. E., ASSISTANT ENGINEER, U. S. N.

The recent Spanish-American war, besides offering a brilliant illustration of American gunnery, entailed the placing

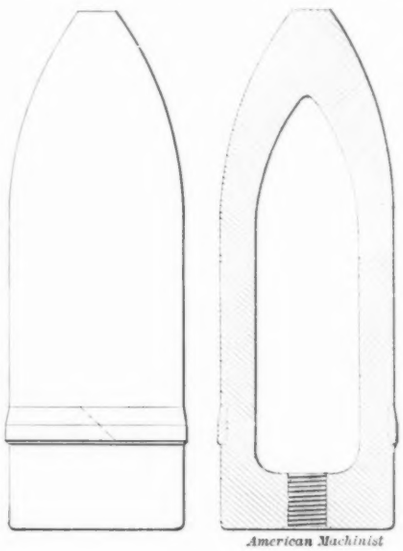

Fig. 1

5-INCH CAST IRON SHELL FOR THE NAVY.

of many contracts for replenishing the naval magazines with the various calibers of shell. The sudden prominence given to both naval and military matters has created a corresponding competition among manufacturers, so that the field of this work has widened, and many concerns have entered upon it with varying success.

There has been a continued advance in ordnance since the time of the smooth bore to the present rifled gun, and, of necessity, a similar advance in the ammunition for these guns. What in accuracy of construction is required in the gun itself must also be found in the shell. The manufacture of shell is essentially an engineering problem. It requires a thoroughly equipped shop, careful and systematic work, and the highest degree of exactness. Details which in the ordinary shop practice play an unimportant part are often of vital importance in this work.

The Ordnance Department places at each of the firms contracting for this work one of its inspectors, all of whom report to the Bureau of Ordnance, and receive their instructions from the chief of the bureau. The inspector is furnished with gages for his work, and, by means of reports furnished weekly, the bureau is kept in touch with the work and its state of progress. A certain allowance or tolerance is granted for each dimension in this work, and the gages are usually maximum and minimum, or limit gages, insuring the shell being within the prescribed limits. The meas-

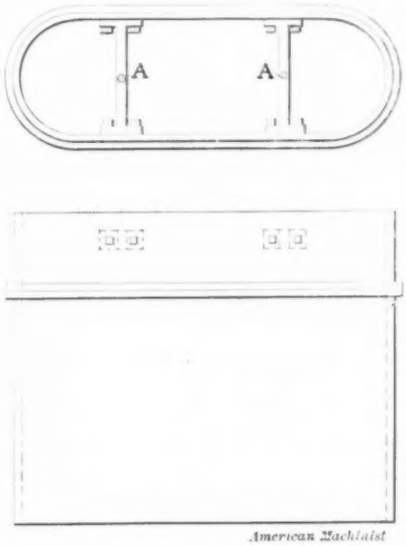

Fig. 2

FLASK, SHOWING BARS FOR SUPPORTING PATTERNS AND CORES.

ures to be taken are: The diameter of the shell above and below the rotating copper band, the length over all, the depth of chamber, the diameter of copper band, the length of fuse hole thread, the diameter of tapping, and the difference of thickness of walls. The weight of the shell must also be within fixed limits. The tolerances on these dimensions vary from .003 inch plus or minus for the diameter of shell to .350 inch plus or minus, for the less important length measurement.

The various kinds of shell, steel armor-piercing and common, or cast-iron shell, widely differ in their processes of manufacture, and I will deal here only with the 5-inch cast-iron shell, Fig. 1, as illustrating the method of manufacture at one of the concerns now engaged in this work.

The iron must be capable of withstanding a pull of 23,000 pounds per square inch before rupture. The tensile strength is obtained by means of test bars cast at the same time as the shell.

The shells are cast two in a flask; the flasks, similar to the one shown in Fig 2, are made of cast iron, each furnished with two supporting bars *A A*, for holding the patterns while molding, and later the cores.

In Fig. 3 is shown a section of one of the flasks with cores in place, the supporting bars being shown in section, above the molds. The shells are molded point up, but are poured point down, and gated as shown at *B*. All the portion of the shell contained in the cope is afterward cut off.

When the molds are completed they are coated with a film of blacking in the following manner: The funnel shown in Fig. 4 is made of tin. It consists of an outer cylinder, at whose lower end are a number of holes. The end *D* of this outer portion is closed, and when in use rests in the hole *H*, Fig. 3. The fluid blacking is poured into the funnel

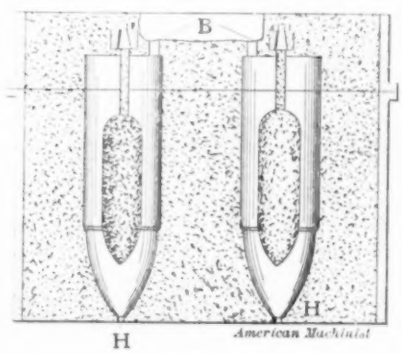

Fig. 3

SECTION THROUGH FLASK READY TO POUR.

F and escapes into the mold by means of the holes in the cylinder *C*. By this means the fall of the liquid is broken and the consequent washing away of the sand

avoided. When the blacking has risen and completely coated the mold, the funnel is lifted and the fluid escapes by the hole *H*, which is afterward closed by means of a small core.

The molds are then put in the drying oven, where they remain twenty-four

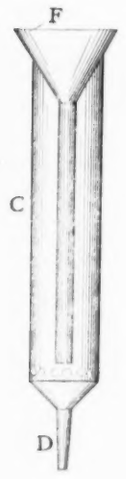

Fig. 4

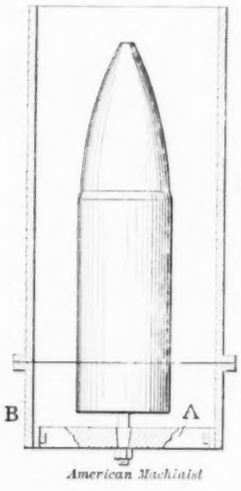

Fig. 5

FOR BLACKING THE MOLD AND HOLDING THE CORE.

hours. They are then cored, and are ready to pour. The cores are built up on arbors made of ¼-inch pipe, drilled so as to allow a free vent for the gases. This pipe is wound with oakum, and the sand then built up in an iron core box. As a means of holding the core in position a steel ferrule is brazed on the lower end of the pipe, and this is turned to a taper to fit the hole in the supporting bar *A*, Fig. 5. In Fig. 5 the pattern is shown in the position in which the mold is made, with the point up. The portions of the shot in the upper part of the flask is approximately the correct total length required.

The tolerance in thickness of walls is .03 inch, which makes the placing of the core of extreme importance. This is most accurately done by means of a thin aluminum cylinder, as shown in Fig. 6. Its outside diameter is the same as the outside diameter of the pattern.

The portion *B* of the flask, which we will consider the cope, is placed in position as shown in Fig. 5. The other part of the flask is, of course, taken off. The core is then fastened in. The aluminum cylinder, Fig. 6, has a hole in its base large enough to fit over the core. The cylinder is then pushed down into the hole left by the pattern, and by means of a caliper set for the proper distance, measurements are taken from the internal surface of the cylinder to the core. The difference is so slight that the core can be sprung into its proper position by bending the arbor slightly.

The portion of the shot held in the cope, Fig. 3 is simply a header, and it is cut off before the shot is machined. More or less dirt will find its way into the mold and this locates itself in this header, rendering that portion porous.

The shells after leaving the foundry are subjected to an examination and all those defective, either because of dirt and consequent honeycombing, or because of misplaced cores, are rejected. The others are then subjected to the first operation. For this the shot is held in a cast-iron chuck, whose interior conforms with the contour of the shell, and the aforementioned header is cut off.

The next operation is to secure the proper diameter of shell. This is done by forcing the shell through dies held in a hydraulic press. For this purpose dies similar to the one shown in Fig. 7 are made, first carefully machined, then hardened and finally ground to the exact size by a small emery wheel mounted on a small motor. The first cut removes 3-32 inch, and the second and final cut

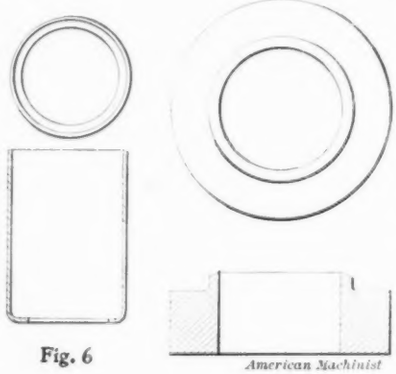

Fig. 6

Fig. 7

GUIDE FOR SETTING CORE.—DIE FOR SHAVING SHELL.

about .003 inch, This leaves the shell the correct diameter below the copper band. The shells are not put through the die point first, but the reverse. A chamfer is cut on the base of the shell sufficient to start it in the die. The upper or pointed portion of the shot rests in a block which is turned out so as to conform closely to the shot. In this way the shot finds it own center before it starts through the die.

The portion of the shell above the rotating copper band is several thousandths smaller in diameter than that below the band. After coming from the finishing die, the shell is ground down to the correct diameter by an emery wheel, and it is then ready for the final machining; namely, facing off the base, cutting the band groove, boring out and tapping the thread for fuse hole plug, and counterboring for plug. These operations, several of which occur simultaneously, are done in a turret lathe. The base is faced off by using the cross feed, while the band groove is made, feeding by hand. The hole in the base is bored out in two cuts, and the first or roughing tap is also run through.

The shell is then taken to a trough, immersed in water, and subjected to an internal air pressure of 50 pounds per square inch. Any leaks indicate porosity and condemn the shell. The easiest way to apply this pressure, and the one which was used throughout the work, is to use a loose or flexible connection, into one end of which is fixed a nipple threaded to fit the fuse hole tapping. After connecting up, the pressure is turned on and the shell is laid in a trough of water. If good, the shell is then tapped out by hand to the required size. This seemed to be necessary because of the severe inspection to which the thread is subjected. The inspector is furnished with a maximum and minimum fuse hole thread gage, or plug. One of these is supposed to go completely home, the other should not enter. The difference in these two gages is but .004 inch. In many cases the tapping was found to be slightly bell mouthed, due to the hole left by the core not being exactly in the center. Consequently the chucking reamer was obliged to cut more on one side than on another, and in so doing enlarged the hole at the mouth. This permitted the maximum gage to enter. To avoid this the first tap was run through in the lathe, but the finishing tapping was done by hand.

This operation completed all the machining on the iron portion of the shell. The rotating copper band was then to be put on and turned to proper dimensions.

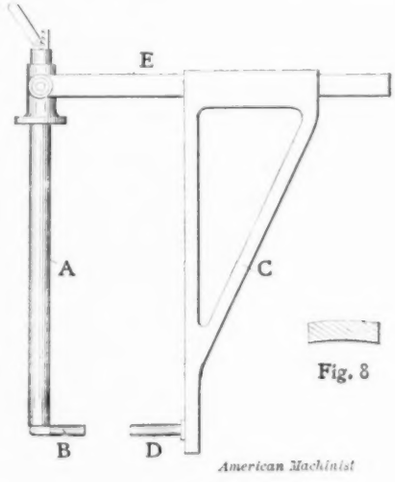

Fig. 8

Fig. 9

GAGE FOR THICKNESS OF SHELLS AND SECTION OF COPPER RING.

The band is made to lap, as shown by dotted line in Fig. 1, and is cut exactly to length, so as to form a neat fit when in place on the shell. The lapping of the bands by cutting the ends at 45 degrees insures a tight fit in the gun. The band is held in place by dovetailing into the

groove cut in the shell. In order to insure a good solid fit the band is made with a section as shown in Fig. 8. In banding, the shell is held in a suitable chuck and the band is placed in the slot and flattened at one end. A roller is then placed against it and the shell is revolved. The copper is thus rolled into the groove cut for it in the shell. As the latter revolves the band is subjected to a great many blows from a small pneumatic hammer, mounted on the lathe. The band is thus flattened out and forms a dovetail joint in the groove.

The tool for cutting the copper band is made with a cutting edge to conform exactly with the template furnished by the Bureau of Ordnance for it. Its cutting edge is made the full width of the band. It is fed in by hand until its extreme points just touch the iron of the shell. The copper band is then of the correct contour, and the diameter is then the specified one, and within the tolerances granted by the bureau.

The shell is then ready for inspection. This, of necessity, is a severe one, as a mistake in measurement is likely to be attended with dangerous results when the shell is fired from the gun. The measurements are all taken with maximum and minimum gages—the diameter above and forward of the rotating band by means of steel rings, one of which fits over the shell, and goes down as far as the band, the other one not allowing the shell to pass through it. The diameter of the copper band and of the shell below the copper band are taken with snap gages, one of which must pass and the other must not pass the shell. Contour templates are also furnished, one for the coned portion of the shell, the other for the rotating band. The depth of the chamber is also taken by means of a steel rod carrying upon it lines indicating the extreme and the minimum permissible depth. The thickness of base is also measured by a similar gage.

The most difficult measurement, and the one upon which most of the shells are rejected, is that for the thickness of the walls. This is taken by means of a wall gage or caliper, Fig. 9, consisting of a rod *A* carrying a contact finger *B*, which enters the shell and is brought in contact with the inner wall of the chamber by means of a rack and pinion. A sliding arm *C* carrying a contact point *D*, and traveling along a graduated scale *E* touches the external surface of the shell. Measurements are taken all around the shell, and these measurements must not differ by more than .03 inch.

If in all respects within the specifications set by the Bureau of Ordnance, the shell is stamped on the rotating band with the anchor, the official stamp of the Navy Department, and with the initials of the inspector accepting it. The maker's name and the material of which the shell is made, together with the year in which it was made, are stamped on the base. The shell is then coated with oil or grease, and the thread similarly treated to prevent rusting, and is thus ready for shipment to the naval magazine, at which it is to be charged.

This work is now carried on at Fort Lafayette, New York. This hitherto harmless and ruined old fort has now been repaired and converted into a most formidable magazine. A large force of men is regularly employed loading and boxing the various sizes of shell used in our navy.

This class of work has offered a comparatively new field to the manufacturers of this country, and from the disturbed and menacing aspect of European affairs it is very probable that some of our American factories may yet turn out shell other than those fired by the Yankee tar at the elusive Spaniard.

▲ ▲ ▲

Practical Motocycles at Charles River Park, Boston, November 9.

In two forms the motocycle can at last, I think, be fairly said to have arrived.

At the contest at Charles River Park, Boston, which took place on the 9th of November, under the management of the Massachusetts Charitable Mechanic Association, there were shown two types of mechanically propelled vehicles which were respectively exactly suited, in practical particulars, to the requirements of two large classes of users. One of these types was what may be styled the "vehicle of elegance."

All the requirements of a carriage for the use of the wealthy class, embodying luxury, cleanliness and fine appearance, were fully met by the Riker and Columbia electric carriages. Large, costly, of noble aspect and limited powers, silent, and managed with but the slightest exertion of muscular force, these fine electric wagons are exactly suitable for a very large class of city dwellers who desire a carriage which can be kept, if required, in their own city residences, and is always ready at an instant's notice to do 25 or 30 miles of travel in imperial style on the asphalt. These carriages cost about $2,000 each, weigh from 1,800 pounds upward, have only a limited range of travel, and demand very costly pneumatic tires to carry the great tire loads imposed; but for all that, they are exactly suited to the service for which they are intended. The storage battery driven wagons are also exactly right in every way for department store delivery wagons, where elegance becomes a delicate compliment to the customer of whatever degree, and is also a conspicuous advertisement of the resources and advanced management of the concerns employing these fine vehicles in the prosecution of their business.

The other satisfactory vehicle appeared in what may be called the "suburban wagon," driven by steam engines, light, silent, swift, of unlimited range, easily managed, perfectly odorless, of ordinary form, eminently respectable in appearance, very low in price, and very economical in operation.

The meeting at Charles River Park was the first public occasion on which a small, light, odorless, easily managed steam motor wagon has ever been shown. With the exception of one objectionable feature, a number of explosion engine vehicles, notably the Duryea, the Winton, and the Haynes and Apperson, are suitable for suburban use and for touring; but until their makers succeed in producing such a perfect combustion that the explosion engine driven wagons leave absolutely no offensive odors behind them, they will be objected to on that account. The steam wagons shown at the Boston contest are absolutely odorless, and silent save for the slight noise of the exhaust, which can easily be entirely obviated if desired, and which can hardly be distinguished from ordinary buggies and phaetons and victorias, except for the thin veil of gray mist trailing four or five feet behind, which is formed by the exhaust.

But—a steam engine?—a pair of slide-valve link motion steam engines—a boiler to supply these small, quick engines with steam—a water supply to be kept up—a strong fire to be maintained and regulated? "Why," the "Machinist" readers will exclaim, "here are all the parts and functions of a full-fledged locomotive—can you expect to find a community of experienced locomotive drivers to successfully operate these delicate and complicated mechanisms?"

To speak the whole truth a high grade locomotive is not anywhere near up to a Stanley, or Whitney, or Mason steam wagon for complexity and perfection of mechanical detail.

Imagine first a locomotive boiler which governs itself to a limit of variation of half a pound pressure. Let the experienced locomotive runner imagine that his boiler does not exist; that he simply has always a full head of steam, without any care or exertion or forethought on his part. It is very hard for one familiar with common forms of steam boilers to picture to his mind a high pressure steam boiler which can take care of itself, standing or running, and has always a predetermined steam pressure, except, of course, when more steam is taken from the boiler than it can produce.

So hard, indeed, is it for a mind familiar with ordinary boilers to even admit the possibility of an automatic steam boiler, heated by a fire producing neither smoke nor smell, that the writer of this

began his study of the Boston steam wagons with the absolute certainty that the steam engine and boiler could never, by any possibility, be given such forms as would make steam a wholly and entirely suitable motive power for a pleasure carriage. This confession is the easier to make since it is pretty certain that every reader of this article who has not seen and ridden in the Stanley and Whitney steam wagons feels perfectly sure that steam cannot be used with satisfaction in motocycles for general service.

The truth is, however, that the Stanley boiler does take care of itself so perfectly that the driver does not think of the steam generation any more than the driver of a horse thinks of the animal's breathing.

With a constant supply of dry steam, a pair of vertical cylinders working on one crank shaft, with cranks at 90 degrees, is the most reliable motor at present known. When, in addition, the valves are driven by links, the double steam engine becomes the most docile, as well as the most certain, of all known motors—far less complex and more certain to obey orders than a horse. The explosion engine motors are idle three-fourths of the time, and hence must have as many as five cylinders and pistons working on one crank shaft before they can approximate the continual torque applied to the crank shaft by a pair of double-acting steam cylinders and pistons. Explosion engine driven motocycles have been made with five working cylinders and pistons, and with four, three and two cylinders, and with only one cylinder, as in the Benz and Winton wagons, which of course require very heavy flywheels. The double cylinder steam engine driven wagon needs no flywheel, and has hill-climbing powers far in excess of even the three-cylinder explosion engine, while the two-cylinder explosion engine driven wagons make spectacles of themselves when hills are to be surmounted.

With the Stanley steam boiler the fire can be lighted and steam raised to 20 or 25 pounds in 4½ minutes, and from that time on, so long as fuel and water are furnished, the boiler takes care of itself.

In the matter of fuel burning, the steam generating fire burns all the time, under the most favorable conditions for perfect combustion. The explosion engine charge has, however, under ordinary conditions, only from the 1-150th to 1-250th of a second in which to effect the combustion of the explosive charge which drives the piston.

The managers of the fair of the Massachusetts Charitable Mechanic Association must have the credit of organizing the best conducted American motocycle event up to date. The $1,100 in prizes was awarded strictly on actual road performances, and except in the "Manageability" tests, everything was arranged on a fair basis, and much executive ability was shown in working through the scheduled events promptly.

The automobiles left the Fair Building on Huntington avenue at about 11 o'clock, and ran over to the Park in fine order, the electrics leading.

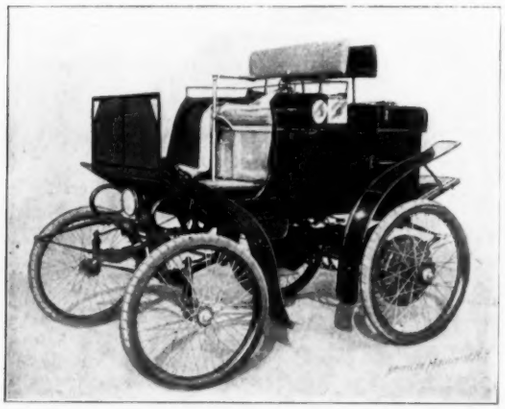

FIG. 1.—COLUMBIAN ELECTRIC FOUR-PASSENGER CARRIAGE.

FIG. 2.—RIKER ELECTRIC PHÆTON.

FIG. 3.—RIKER ELECTRIC TRICYCLE FOR TWO OR THREE PASSENGERS.

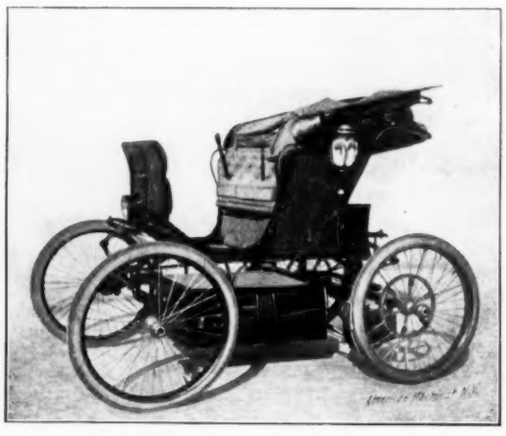

FIG. 4.—EATON ELECTRIC CARRIAGE.

There were shown at the Park one Columbia electric carriage, one Riker phaeton, one Riker electric tricycle, one Eaton electric carriage, one Boston Haynes & Apperson explosion engine driven carriage, three French vehicles, one a tricycle by Leon Bollee, Paris; one a tricycle by the De Cauville Company, Paris, and one four-wheeler by De Dion et Bouton, Paris (all of these French wagons being explosion engine driven), and two Whitney steam motor wagons. All of the foregoing were entered as contestants for the prize money. There were also on exhibition by courtesy at the Park, one Duryea wagon and one Stanley steam wagon.

The day was fair and very warm, and about 2,000 spectators were present, a large proportion of them being evidently business men and capitalists, having far more than a merely curious interest in the exhibition.

The track at Charles River Park is three laps to the mile, asphalt, banked at the turns, and, while a very good cycle track, is wholly unfit for a speed contest between heavy four-wheelers. For this reason the Columbia and the Riker carriages took no part in the speed trials. The Columbia carriage did not take part in any competition, nor did the Eaton, which was begun on September 9, first placed on the road October 31, and was not fully completed on the day of the contest.

The first function at the Park was a parade, headed by the Riker phaeton, with the president, Riker, driving.

The first competition was a pursuit race between two of the French wagons. These French automobiles all had very small wheels, were all noisy, and all emitted vile odors in abundance. They were also all prompt and powerful machines in track work, were driven by riders who handled them to perfection, and they captured nearly all the money in sight. None of them carried its passengers with any degree of comfort, and they were all of insignificant appearance.

The second event was a pursuit race between the two Whitney steam wagons, No. 12, driven by Whitney, winning promptly.

The third event was a 2-mile run, 6 laps, by the Whitney steam carriage, No. 12, Whitney driving, made in 5.40 2-5.

The fourth contest was a 2-mile pursuit race between the De Dion four-wheeler and the Haynes & Apperson, won by the De Dion in 7.42 4-5. The De Dion four-wheeler is a low-geared vehicle, and the time was more than 2 minutes slower than the winning French tricycle made later.

The fifth contest was for brake efficiency, between the Riker phaeton and the Whitney steam carriage No. 12. Won by Riker.

Then came a brake contest between the De Cauville and the Haynes & Apperson; won by the American.

The seventh event was the final pursuit race, between Whitney in his steam wagon No. 12, and one of the French tricycles; won by the latter, which made the 2 miles in 5.01 2-5, and so took the $500 speed prize. Whitney is said to have often done a mile in less than two minutes on a straight track.

After a "Manageability" trial Stanley drove his steam wagon in a mile exhibition run, made in 2.11, or at the rate of 2 miles in 4.22, as against the French tricycle 2 miles in 5.01 3-5, which captured the speed money. Stanley's run was loudly approved by the spectators, and the stillness of the Stanley wagon, its light weight, its absence of

FIG. 5.—DE DION EXPLOSION-MOTOR DRIVEN-FOUR-WHEELER FOR TWO PASSENGERS—WINNER OF THE $500 PRIZE.

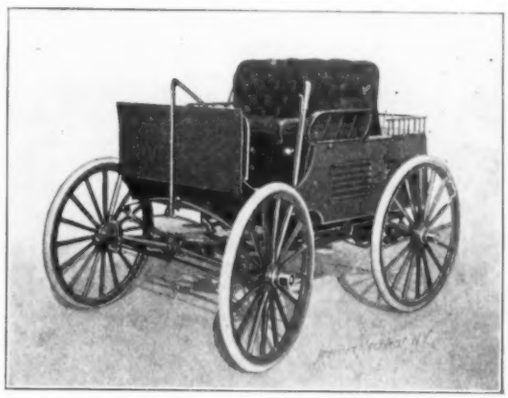

FIG. 6.—HAYNES & APPERSON EXPLOSION-ENGINE-DRIVEN CARRIAGE.

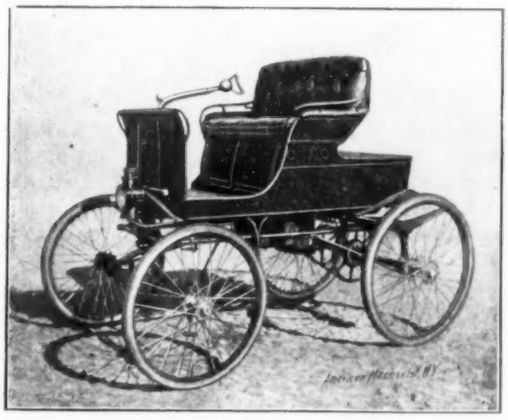

FIG. 7.—THE WHITNEY STEAM CARRIAGE.

FIG. 8.—THE STANLEYS IN THEIR STEAM WAGON.

odor, and its speed, won great favor. Then came the hill climbing trials, which were made with a standing start on a wooden structure, shown in profile to scale in Fig. 9, as dimensions were given by an official. This hill had a track made of rough boards laid crosswise, the first 20 feet being level, the next 10 feet rising at a 5 degree angle, the next 10 feet at 15 degrees, and so on, to a final angle of 35 degrees.

Riker and Whitney showed well on the hill, Riker about covering the 25-degree angle as nearly as could be judged, and Whitney doing a little better with 100 pounds of steam. The explosion motors did not show so well, the standing start giving them no opportunity to bring their flywheels up to speed before the climb began. The Haynes & Apperson did much better, however, than the French machines, which had hard work to cover the 15-degree angle. Then the Stanley wagon gave an exhibition run

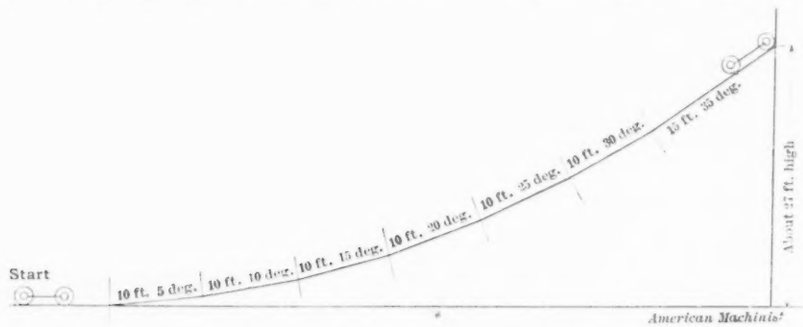

FIG. 9.—PROFILE OF CHARLES RIVER PARK "HILL" USED IN MOTOCYCLE HILL CLIMBING TRIALS.

up the hill, standing start, and bumped the cross bar at the top. The Stanley brake is not effective on a 35-degree incline, and catchers were stationed on each side at the top of the incline to catch the wagon; 35-degree incline gives a very insecure foothold, and for an instant it looked as if Stanley and his wagon and the catchers were all going to roll down the hill in a bunch; fortunately the catchers held on, and the descent was effected without accident.

Then Whitney made another trial with his steam wagon No. 12, this time with 125 pounds pressure, went to within a few feet of the top, won the contest, and ended the exhibition. The Stanley wagon appeared to accelerate well into the 25-degree angle, and could have gone higher on the 35 degree angle, as it gave the cross-bar at the top a perceptible bump.

Particulars of the various vehicles present at Charles River Park are as follows, so far as known. Some of the contestants declined to give detailed information.

Riker Phaeton—Wheel diameters, 32 and 36 inches; tire diameters, 3 inches; price per set, $150 to $200. Wheel gage, 50 inches; wheel base, 63 inches; total weight, 1,900 pounds. Price, $2,000. Motor, 1½ K. W.; weight of motor, 160 pounds; battery, 40 cells, Willard Battery, weight 1,000 pounds. Ratio of gear reduction, 12 to 1; spur gear. Ball bearings throughout; compensating gear and continuous driving axle, Riker's patent.

Riker Tricycle—Wheels all 28 inches diameter, 2½-inch pneumatic tires, $50 per set of three. Single rear wheel propulsion; total weight, 800 pounds; price, $850; motor, single, ¾ K. W.; weight, 70 pounds; battery, 350 pounds weight; speeds, 3 forward, 2 back; gear reduction ratio, 12 to 1; spur gear. Springs, 2 in the rear, double "C," in front half elliptic, all with link suspension. Steers with front wheels. Weight on driver, one-third of total.

Haynes & Apperson, Boston—Wheels 36 and 38 inches; tires, cushion, 1¾ inches; cost, $60 per set; gage, 54 inches; total weight, 1,300 pounds; two-cylinder explosion engines, stated to be 4 H. P.; said to require 1 gallon of gasoline to 20 miles run, and 30 gallons of cooling water per day; three speeds and reverse; chain and sprocket and friction clutch transmission from engine shaft to driving wheels. Ball bearings on rear driving axle; roller bearings forward.

Eaton Electric Motor Carriage, Boston—Wheels all 34 inches diameter; 3-inch Newton Rubber Company pneumatic tires; two motors, 1 horse-power, on each side, rear wheels independently driven; gear reduction from motors to wheels, 10 to 1; naked spur gearing; original design of motors and controller; 40 cells, Willard battery; weight, 720 pounds; total weight, 1,200 pounds; range, 30 miles on level asphalt; wheel gage, 56½ inches; wheel base, 63 inches; side lever for steering. A notable feature of the Eaton wagon is the separation of the battery from the carriage body, as clearly shown in the engraving, the batteries being carried below the side bars, on half elliptic springs.

George E. Whitney's Steam Wagons—Whitney showed two wagons, No. 2 and No. 3 of his manufacture. His first wagon weighed about 650 pounds empty. Wagon No. 2 weighs about 750 pounds empty, and is the wagon Whitney himself drove at Charles River Park. Wagon No. 3, also shown at Charles River Park, weighs 1,120 pounds empty. Whitney's engines are a pair of simple cylinders, 2¼-inch bore by 4-inch stroke, geared down 5 to 1, on 38-inch driving wheels, divided shaft and compensating gear; sprocket and chain reduction, chain 2-inch pitch and chain blocks 1-inch face. The Whitney boiler, fire-box, burner and engines weigh 175 pounds all told The engines have slide valves driven by a shifting valve crank-shaft, the equivalent of a shifting eccentric. Whitney is now building his eighth steam wagon, no two alike, and is devoting his attention to an improved power transmission from the engines to the driving wheels, as he regards both gears and chains as unsatisfactory. He has sold his steam wagons, so far, at about $2,000 each, Whitney uses 2½-inch pneumatic tires, with 100 pounds air pressure.

The Stanley steam wagon weighs about 400 pounds empty, and has all four 28-inch wheels, wire suspension spokes, laminated wood rims, and 2-inch Hartford tandem cycle tires, at $12 for the set of four. His engines are a pair of vertical cylinders, 2½ inches bore by 3½ inches stroke, plain eccentric valve motion, D-slide valves, non-reversing cut-off at about 9-16 stroke, built by J. W. Penny & Sons, Mechanic Falls, Me. The engine shaft is geared by a chain to the divided rear axle compensating gear, 12-tooth sprocket on engine shaft, and 30-tooth sprocket on gear.

Stanley's actual weights at Charles River Park were: Wagon with full supply of water and gasoline, 510 pounds, and with Stanley himself driving the total weight was 665 pounds. Stanley uses regularly 130 pounds steam pressure, which was what his gage showed at the beginning of the 2.11-mile run; at the finish the pressure was between 85 and 90 pounds. Steam was throttled all through this run, because of the short turns, and even then the wagon ran high up on the banking.

Stanley proposes to sell a steam wagon weighing empty about 360 pounds, to carry two passengers, for $600; and a two-seated wagon for four passengers, to weigh about 450 pounds empty, for $700. He uses the Baldwin chain, and believes it amply heavy. The Stanley machinery is not cased in on this wagon, but will be entirely protected from dust in his commercial model. The engine crank shaft is carried on four-point ball bearings, and there are four-point ball bearings on the crank pins. All of the wheels are on ball bearings, and the intention is to make this wagon full ball bearings throughout.

Stanley's work will attract the greatest interest as soon as it becomes known, as he is going to the extremes of light weight and ball-bearing use. As the Stanley boiler details are not yet patented they cannot be described in detail at the present time; they are of great originality, and give a low cost, strength, and perfec-

tion of combustion, which are unprecedented in the writer's experience.

Stanley is now building a racing steam wagon for one passenger, which will weigh only about 275 pounds empty, and with which he expects to make the mile in 80 seconds, on a straightaway track.

It costs for electric current about $10 per month to drive a Riker electric carriage, say, 25 miles every day.

Stanley says that he can run his steam wagon 25 miles with 1 gallon of 7-cent gasoline, and 12 gallons of water. The wagon carries, when full, 4 gallons of gasoline and about 150 pounds of water. If the Stanley can run 25 miles on 1 gallon of 7-cent gasoline, the full cost is well under one-third of a cent per mile.

Whitney says his wagon No. 3, which weighs 1,120 pounds empty, will travel 75 miles on 8 gallons of gasoline, costing 56 cents, or a little over two-thirds of a cent per mile.

The Boston, Haynes & Appérson explosion motor wagon was said by Mr. O. H. Perry, to run 100 miles on 5 gallons of gasoline. This wagon weighs 1,300 pounds.

From these statements it appears that the steam wagons use no more fuel than the explosion engine vehicles.

HUGH DOLNAR.

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The Rotary Blower as an Air Compressor.

BY FRANK RICHARDS.

Practically all the air with which we come in contact or that we have to do with is compressed air. We apply the term compressed air, however, only to such air as is abnormally compressed, usually by artificial means, and so that the subsequent release of the air, from its state of abnormal compression to the lower pressure due to the effect of gravity alone, may accomplish for us some useful or desired purpose. There is a generally recognized distinction between a blower and an air compressor. A blower is generally understood to be for the sole purpose of giving motion to a body of air, or to be a means of causing its transmission from one point to another with little or no surplus pressure at the point of discharge. The air supplied to cupolas or to blacksmith fires is for the sole purpose of supporting combustion, and only enough force or pressure is required to carry it into the interstices of the burning masses in sufficient quantity. For this in many cases quite an appreciable pressure is required, and for most purposes it is also desirable to deliver the air in determinate quantities. As securing these desirable conditions more effectively, the pressure blower, or the rotary blower, has of late years largely superseded the fan so generally employed before. The rotary blower, it must be remembered, is, however, still a blower. Its success as a blower may have led it, or its backers, to assume that it must therefore be efficient and satisfactory also as an air compressor, but there seems to be a pretty well defined line of service beyond which the rotary blower, at least of any of the familiar types, may not be expected to successfully pass. In fact, a very good blower, or one that produces a difference of pressure between its inlet and its outlet of a couple of pounds or so, transmitting at the same time a considerable volume of air, may be a very extravagant and unsatisfactory air compressor, even for a pressure of only one additional atmosphere, while for the still higher pressures to which air is generally compressed the use of the rotary blower would be an impossibility.

It is now generally understood—I have personally done what I could to maintain and to diffuse a knowledge of the fact—that the range of economies in the application of power to air compression lies entirely between adiabatic compression and isothermal compression, the former representing the greatest possible

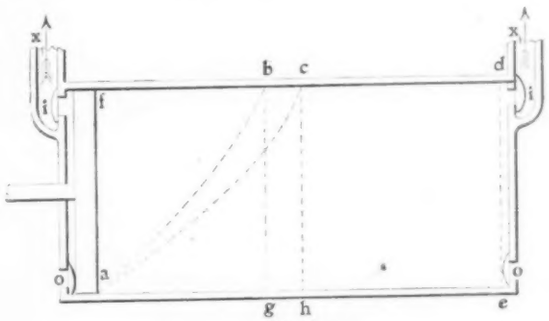

Fig. 1

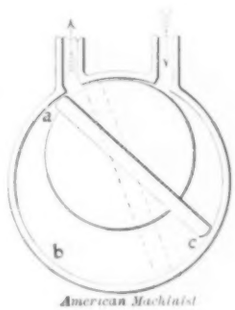

Fig. 2

ACTION OF THE AIR IN A ROTARY AIR COMPRESSOR.

loss, while the latter would be the ideal condition, or compression without sacrifice of power, so far as the air itself is concerned. All this is still true, but it is quite possible to produce a compressor whose operation will involve a much greater loss of power than that involved in adiabatic compression, and a loss entirely independent of and in addition to the losses due to friction and leakage. This condition is furnished by the rotary blower, and is, as far as I know, inseparable from it, also, it would seem necessarily fatal to the claims of the rotary blower to be recognized as a respectable air compressor.

The condition referred to may, perhaps, be best understood, or at least best appreciated, by reference to an air compressor of the familiar reciprocating piston type. Fig. 1 may do for a sketch of an air compressing cylinder and its appurtenances, it being of course either vertical or horizontal. The valves *o o* open inward for the admission of the air and close at the end of the stroke, while valves *i i* open outward for the delivery of the air when compressed. The pipes *x x* lead to the compressed air reservoir, and when the compressor is in operation the delivery pressure is maintained in this pipe. We may assume that the compressor is compressing and delivering the air at 15 pounds gage pressure. Then *a b* will be the compression line for adiabatic compression and *a c* for isothermal compression, and *a b d e* will represent the work done in compressing the air without any cooling and in expelling it from the cylinder against the 15 pounds of unbalanced pressure, while *a c d e* will represent the same operations if the air could be compressed without rise of temperature and then expelled.

Now, it would of course be an absurd thing to do, but it would be possible, with the piston in the position shown, ready to begin its stroke of compression, to open the delivery valve *i* and fill the cylinder with compressed air from the receiver. The admission of this air would compress the contents of the cylinder to the receiver pressure, and all that the piston would have to do would be to expel the air at the increased pressure. This work would be represented by the rectangle *a f d e*, which is, of course, much more than either of the previous operations. The mean effective pressure for *a c d e* is 10.33, for *a b d e* it is 11.51, but for *a f d e* it is 15 pounds. With the first operation representing perfect efficiency, or 100 per cent., the second would be 89.75 per cent., and the third would be 68.86 per cent., and with 10 per cent. deducted in each case for the friction of the machine these would become respectively 90, 80.77 and 61.97. These figures would be still further reduced by the necessary deductions for leakage, but this it will be better to notice a little later.

Now, although the tripping open of the delivery valve at the beginning of the compression stroke would be, as was remarked, an absurd thing to do, and would also require more or less ingenuity, or at least a considerable going out of the way to accomplish, it is precisely the thing which actually occurs in the rotary pressure blower. The sketch Fig. 2 I suppose does not unfairly represent the peculiarities of the rotary blower. It certainly is not intended to be unjust. The central slotted, but otherwise solid, cylinder is placed eccentrically in the shell, in which it revolves in the direction

of the arrow. It touches or runs as close as possible at one point at the top of the sketch to the inner surface of the shell. The blade is free to slide in the slot in the revolving cylinder, and at both ends of it travels in contact with or as close as possible to the shell. The shape of the shell will not be exactly circular, as was shown in the description of an air motor in the "American Machinist" May 12, this year; but that does not affect the operation. The air enters at the right and is delivered at the left, as shown by the arrows. In the position in which the blades are shown in full lines the space *a b c* is filled with air at atmospheric pressure, but by the time the cylinder has revolved to bring the blades to the position indicated by the dotted lines this space has become full of air at the delivery pressure by the opening of communication with the delivery passage, and the entire contents of the space, or considerably more than that which entered it by the legitimate inlet *d*, must be expelled against the full delivery pressure. By this constant re-entrance of a considerable volume of air, which already has been compressed and delivered, the rotary blower, applied to air compression, has to do quite a large portion of its accomplished work over again for each semi-rotation and without any compensating circumstances. Practically the same thing occurs with the duplex or two-impeller blowers, and with all the machines of the rotary type without actual valves for retaining the air when once delivered.

It might be possible to provide the single cylinder rotary blower here sketched with a check valve that might, theoretically at least, help the matter, but this would be impossible with those of the two-impeller type, as one or the other side is constantly delivering, and in any case it would not be worth while to try it as a means of increasing the efficiency of the rotary blower at higher pressure on account of the second uneconomical feature which is inseparable from it, which is the leakage. We are told by the makers of the blowers that the impellers should neither actually touch each other nor the shell in which they revolve. There are, then, long lines of approximate contact through which the advance air is constantly struggling backward. The only packing device is a thorough greasing of the surface, which is reasonably effective for pressures of a pound or two; but we can easily understand what the leakage becomes at high pressures. This leakage or flow of the air backward, increasing as the square root of the unbalanced pressure, would at 4 pounds be double what it would be at 1 pound; at 15 pounds it would be 3.872 times as great as at 1 pound, while at 75 pounds it would be 8.66 times as great, so that the pressure would not have to be increased so very high before the compressor would actually leak away all that it attempted to deliver, just as I once saw two 16-inch reciprocating compressors, of good make and in excellent condition, fail to raise the pressure above 80 pounds, although no work was going on, all the air which they delivered leaking away through a lot of valves, which were outrageously bad, and probably the worst job that ever I saw. It is impossible to fix precise limits within which, all things considered, the efficiency of the rotary pressure blower is confined, but it is probably safe enough to put the upper limit of it at 5 pounds, as is done by at least one firm. The reciprocating compressors show a rapidly increasing preponderance of efficiency for the higher pressures.

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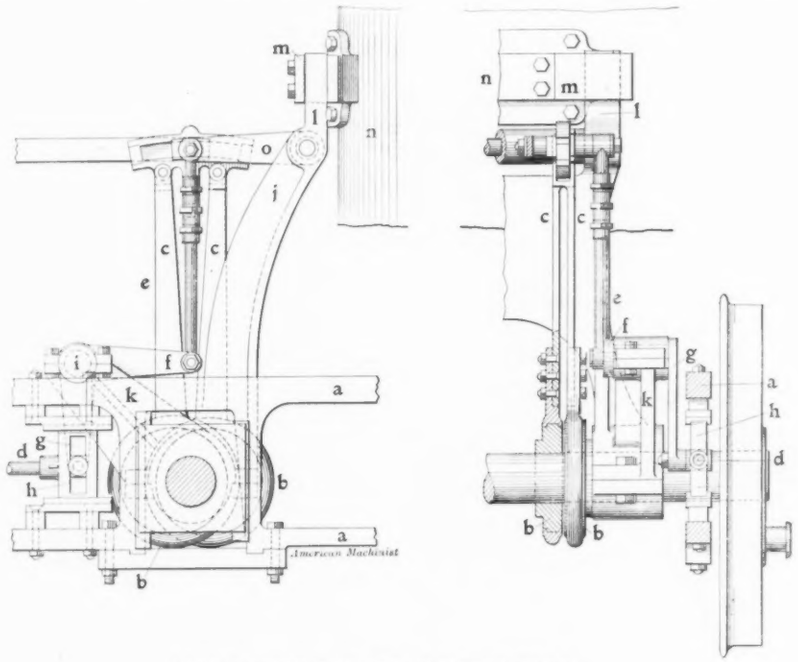
A Link Motion for Steam Motor Cars.

Owing to the fact that the cylinder of a locomotive and its attachments are bolted to the frame, while the eccentrics are carried by the shaft, the rising and falling of the frame on the axle boxes tend to disturb the action of the valve. In locomotives proper this action is too small to need correction, but in the steam motor cars, which are being adopted for suburban traffic on some roads, it is more serious. This is due partly to the fact that the engine, with its valve and valve movement, is small, in consequence of which a given amount of disturbance is relatively of more importance than in a larger machine, and partly to the fact that with motor cars the same springs carry both the engine and the passengers, and the comfort of the passengers requires the use of more flexible springs than would be used for the locomotives alone. Such springs increase the movement of course, and correspondingly increase the disturbance of the action of the valve due to it.

The accompanying illustration shows a modification of the usual link motion, intended for use on steam motor cars and designed to prevent the disturbance of the valve due to the movement of the frame relatively to the axles. The frame will be seen at *a*, the eccentrics at *b b*, the eccentric rods at *c c* and the valve rod at *d*. The eccentrics will be seen to act vertically, the movement of the link being communicated to the valve rod through the rod *e* and bell crank *f g*, the pin at the lower end of *g* acting on the valve rod through a slotted cross-head *h*, by which connection the pin may rise and fall in the cross head without disturbing the position of the valve. The entire link motion, up to and including the rock shaft *i* of the bell crank rocker, is carried on the axle through the two-armed casting *j k*, the upper arm *j* of which is kept in position by an extension *l*, which slides freely in a sliding bearing *m* attached to the vertical boiler, a portion of which is seen at *n*. The arm *k* carries the rock shaft, and the arm *j*, through a link *o*, controls the position of the block in the link. A moment's reflection will show that the frame and cylinder may freely rise and fall on the axle box through the range provided by the length of the cross-head *h* without materially affecting the action of the valve.

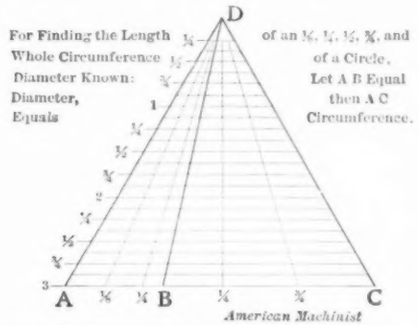


LINK MOTION FOR STEAM MOTOR CARS.

The gear described is the design of Mr. S. M. Vauclain, superintendent of the Baldwin Locomotive Works.

A Universal Circular Scale.

We reproduce, somewhat reduced, from the columns of "Engineering News," a useful diagram from which may be obtained the lengths of the circumference, or of various arcs, of a circle when the diameter is known. The designer of the diagram or scale is Mr. J. Ernest G. Yalden, superintendent of the Baron de Hirsch Trade Schools, of this city. The length of the diameter, and the other related lengths to be ascertained, are read from the horizontal lines for the respective diameters indicated by the figures. The diameter lengths are those of the horizontal lines from line *A D* to line *B D*, while the lengths of the corresponding circumferences are the same horizontal lines, but measured from line *A D* to line *C D*. So, for the shorter arcs, the length of an arc of one-eighth of a circle of a given diameter will be along the proper horizontal line from line *A D* to the next oblique line, the length of an



SCALE FOR DIAMETERS, CIRCUMFERENCES AND ARCS OF CIRCLES.

arc of one-quarter of a circle will be from *A D* to the second oblique line, and so on. Taking the base line as an example, if *A B* is 3 inches, *A C* will be found to be 9.42 inches, which is the circumference of a 3-inch circle. The measure from *A* to the central vertical line will be 4.71 inches, which is the length of a semi-circumference for a diameter of 3 inches.

The diagram is of course equally correct for any odd diameters not indicated by lines or numerals, by taking the measure at the proper place on the diagram and along lines parallel with those given. If the circumference is given, and found by measuring horizontally across the diagram at the proper place, the diameter is at once obtained. This diagram is of easy construction, and if drawn full size should be useful in the drawing room, and also for sheet-metal workers and others.

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Electric Motors on Lathe and Shapers.

The electric driving of individual tools or machines has now become so common that it is only in special cases, where peculiar conditions occur, that it is worth while to mention the application of the motor. The time may not be distant when the machine-tool builder will make and list all his standard tools both with and without motors attached, so that his customers may be suited either way. The latest tool to come into this category is J. J. McCabe's now well-known two-spindle lathe. He has lately placed one of these lathes, motor driven, in the Edison electric station, Duane street, in this city. The motor takes the place of the cone on the main spindle of the lathe, and the arrangement is compact and neat, while the running of the lathe is all that could be desired.

Gould & Eberhardt have also applied the electric motor to their well-known shaper.

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Letters from Practical Men.

Packing Returned Machine Parts.

Editor American Machinist:

There are many ways of packing parts of machinery for shipment, as nearly every superintendent knows, ofttimes to his sorrow. When he receives them in all stages and degrees of rust and wreck, the assertion that they were "shipped in good order" does not help either his condition of mind or his opportunities to restore the parts to a presentable condition.

Some examples of the peculiar methods of packing may be given as a matter of everyday experience, and also, it is hoped, as a hint to those who do this work.

Three or four gears are taken off a machine because they are worn out or broken, and they are returned as samples to be duplicated. There is no attempt made to wipe off the months' accumulations of grease and dirt; they are worn and broken, frequently battered in getting them off, yet they are carefully and separately wrapped in paper after paper and as carefully packed in a stout box. It is a case of mistaken zeal, and naturally causes a smile at the other end of the line when the box is opened and its carefully packed contents are exposed to view.

The same day, perhaps, there arrive other parts of a machine, or a whole section of the machine with its parts in place. They are comparatively new, and there is some slight defect to remedy or a different proportion of gearing is desired to effect some special result. To make sure that no part could be injured in transit, the shipper has put the whole mass in a box and then carefully filled in every available part with sawdust, and sent it on its way. Unhappily for his honest but misguided effort, the weather is damp, the box stands on the platform at the station and gets rained upon. The sawdust absorbs all the water that comes to it, and brings it into contact with the finished iron and steel surfaces, with the result that when it arrives it is covered with a layer of rust that necessitates its being taken apart and polished and again assembled before it presents a creditable appearance.

Another shipper packs a similar box, using "excelsior" to fill in the vacant spaces, and with nearly the same result, only that the larger polished surfaces have most peculiar figures wrought upon them by the convolutions of the damp excelsior.

It would seem that a little thoughtfulness would avoid much annoyance and save considerable useless expense, for extra work always costs something, and somebody has to pay for it. If it falls on the thoughtless shipper, it is only right and proper.

Old, worn out and broken parts may just as well be thrown loosely into a box with no attempt to wrap or protect them; just see to it that they "get there." Parts that are to be used again, and that it is therefore desirable to protect from rust or injury, should be well greased over with slushing oil, packed in a box large enough to easily contain them, kept from contact with the sides of the box by strips of wood and then fastened securely in place by other strips or blocks so that no part can move about. If no slushing oil is at hand, get some cylinder oil from the engineer and apply that. But by all means let every polished surface be completely covered with some kind of grease. If the box is to be a long time on the road, of course the grease used should be free from acid, as its presence will so corrode the finished surface, of cast iron particularly, as to leave a dirty, brown color that will require repolishing as much as any other condition of rust will. The same is, by the way, true of finished work in the shop, and should receive more consideration than it generally gets.

A little attention to the points mentioned will save considerable annoyance and disappointment, and frequently some useless expense as well.

OSCAR E. PERRIGO.

New Haven, Conn.

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Rough Work That Is Good Work.

Editor American Machinist:

I have great admiration for and hearty appreciation of the fellow who knows how, and who upon occasion does what you may call a cheap, rough job. It is a kind of skill that really everyone needs for a considerable portion of his lifework. We all at times must have cheap and quick results, and these are not to be secured by minutely painstaking efforts. It is well enough to be proud of what we can do, and proper enough to keep our hand in, but still the man should consider himself favored rather than otherwise who is not bound every minute to strain himself to do his most exacting and excellent work, and I suppose that not many are so bound. We are none of

us too skillful and exact when the best work is called for, but not many of us get a chance to do our best work all the time, and some don't seem to get such a chance at all. One of the commonest experiences is the feeling that we are capable of better things, and that we ought to be in something higher than our present occupation, or at least than in the special niche where we are individually stuck. I suppose that if we go into a diamond cutting works or where they polish astronomical lenses, there also are different grades of work to be done, and certainly in the machine shop, in the building of steam engines or linotype machines, all men cannot all the while get a chance to do their best, and, as I was saying, some may never get such a chance.

I was foreman for a number of years of a shop that was run to make money, and where money was made. We did various grades of work, from the cheapest and roughest to much that would be called good work almost anywhere, and which required skill and care for its satisfactory execution. I of course had various styles of men to deal with, but I must confess that I had no greater trouble than with some of the men who had a notion that they were fine workmen, with a reputation and a dignity to maintain as such, and whose ideas of fine work seemed to be inseparably connected with fine feeds and slow speeds, and whom it was almost impossible to get out of their funereal gait. These fellows never seemed to be able to realize that they were not after all the real fine workmen of the establishment.

What has started me in this line just now is something not very intimately connected with the internal economy of the shop, or with the details of its management I suppose that most of the readers of the "American Machinist" ran over the report of the recent meeting of the American Society of Mechanical Engineers. I happened to get hold of the full printed copies of the papers, and there was one of them that interested me considerably. It was the paper with a long title by Mr. Norris, which gave an account of the testing of the entire mechanical plant of one of the big anthracite coal mines of Pennsylvania. The peculiar style of the testing was what interested me, as well as the results obtained. It was what you might call in some respects a rough job, as jobs of that character are usually done, but it was, nevertheless, to my thinking, an excellent job all the same, and just right for the conditions under which and for the purposes for which it was conducted. The job of making a test of an extensive steam power plant is just like any other job in one respect. It makes all the difference in the world what is the object to be attained by the test. In this case the object was to find out in a large and general way why they were burning too much coal and what they could do to better it. The plant was an extensive one, and if the test had been conducted with the minute elaboration of detail which is very properly insisted upon at our technical institutions and elsewhere when it is desired to determine with the utmost accuracy the ultimate possibilities of performance of engines, pumps or other machinery, a year might easily have been spent in the work, in accumulating the necessary apparatus, in testing and calibrating the same, in planning and formulating the operations to be conducted, in conducting the actual tests, and in collecting and tabulating the results, and a lot of high-priced men might have found honest employment for the whole time.

As it was, it is shocking to relate that the tests of the boilers were made without actually weighing the water, the coal or the ashes, but still an approximate knowledge of the performance of each was obtained. Indicator cards were taken from every cylinder using steam around the mines, but even these were not elaborately worked out. The cards, however, spoke for themselves, and they told a pitiful tale of maladjustment and neglect, to say nothing of original errors of design which it was not the purpose of the test to reach. The practical results which followed the test were that the valves of the engines were reset and the pipe lines were repaired, and in all twenty-six boilers were rendered superfluous and were thrown out of use in consequence of the simple corrections which the tests suggested. In view of the results accomplished it is simply childish for any of the fine workmen of the elaborate and exhaustive style of testing to get up and find fault with the work, although it is not at all surprising that some such fault finding should have been done when the paper was presented at the meeting of the society. It was good work deserving only of praise.

TECUMSEH SWIFT.

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To Mend or Burn a Casting.

Editor American Machinist:

To burn or mend a casting that may have a slight defect, and thereby save what has cost something in time and material to make, is often the best economy, as it also saves time between the casting and the finishing in the machine shop. It often happens, too, that parts of a machine get broken, and, if mended, certain finished parts can be retained and readjusted with little cost. All of which it is desirable to accomplish.

The objection to this is that the casting is liable to be hard and unworkable, and particularly so if it is light. By many foundrymen this job is dreaded, and avoided, if possible, for the reason that soft, workable welding is uncertain to secure.

The general practice is after removing the scale, and having all preparations made, such as fitting cores (if needed), heating the casting, bedding in the sand, and properly securing, to pour in sufficient hot liquid iron to insure the melting of the edges and solid parts around the defect, so that complete union of new and old will be accomplished; then, after pouring, to build a charcoal fire or pile the hottest sprueheads and chunks of iron to be procured about or under the part mended, or both, to keep that burned part hot and anneal it or prevent its too quick cooling, so that it may perhaps be soft. I say perhaps, as it is more often hard than otherwise for several reasons; one is, that the heat from this too often "funeral pyre" does not get uniformly around the burned portion and does not get "right down to the bone" on any side. The heat being all on top, it goes up, and the crevices in the pile of hot junk often make passages for air to pass, and too rapidly carry off the heat.

To obtain a soft, workable mend I have been invariably successful by the following method or process. It should be done as soon as the metal is sufficiently solid or as early as possible after the pouring. Take out of the mold, gently rapping to remove superfluous sand, and put at once in the core oven, where previous provision has been made for it as to its position near the hot fire, with plates or bricks to obtain the most heat and to keep it nearly or quite red hot, for the very longest time, until morning if possible. It will be found when cooled and taken out of the oven to be almost as soft and workable as any other portion of the casting.

This is much easier and more cleanly than the first mentioned method, allows the casting to stay heated more evenly and to be more uniformly cooled. With pieces too large to be lifted by hand this cannot be as quickly done as with light ones. I have, however, mended large work right on the core carriage, first heating it in the oven, and also have a fire on the place where burn is needed in addition. When thus prepared pull out the carriage, pass the welded or burned portion and run the carriage right into the hot oven again and let it stand until morning. With this method I have never been disappointed as to the results. L. C. JEWETT.

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A Backing-off Attachment for a Lathe.

Editor American Machinist:

The accompanying sketches are from working drawings of a lathe attachment for backing off cutters, or, perhaps we had better say, for making formed cutters. In describing the attachment I will

begin at the carriage. Those familiar with the different makes of lathes will recognize this as a Pratt & Whitney. It is 16-inch swing, and has a rigid carriage with a toolpost that is adjusted straight up and down by a screw in the center. One of the first things to settle was how to feed the cutter into the work after getting the attachment all connected up and having used the only cross-slide. This came very easy, for, as all know who are acquainted with this toolpost, if one raises it high enough the screw comes out of its nut, and then it may be laid away, leaving the lower part, with the stump, a most excellent place to put on a compound rest, and this would also be a handy thing to have occasionally for other work.

The box *A* is bolted in one of the T slots, and has besides a ledge cast on it to hook against the inside of the arm of the carriage and insure against slipping back. This box carries the roller head *B* with its six rollers and studs *D* operating against the cam piece *E* and getting power through the shaft *F*. This shaft is geared at the head of the lathe very much the same as the lead screw is geared for screw cutting, and is held firmly in the box *G*. To connect the gearing we generally use only the arm on the box *G*; but sometimes, the combination being difficult, we have to compound them and mount gears on both arms to get the required ratio; we also have to fasten the free ends of the arms to the headstock by a simple little piece not shown.

By examining Fig. 2 it will be seen that the curve of *E* is such that the rollers give it a steady forward movement from the time of starting at the upper part of the curve until it lets go at the bottom. The capstan head screw *H*, Fig. 1, fastened with a set screw *I*, which has a brass seat, is for setting the cam piece *E* out or back, as may be desired, for the requisite amount of clearance. We sometimes make cutters for wood work with four, three and even two teeth. We can hardly gear the shaft *F* slow enough for this, so we take out the roller head and drive out every alternate stud, or perhaps drive out all but two, and those of course opposite each other. In this kind of cutter, of course, the formed places on the cutters extend further around, so we put in a longer cam piece, *J*.

In setting up a job in the lathe we have to take out the cross-feed screw, or at least take the screws holding the bearing part way out, and then, unless the operator gives it a good deal of attention, he will get into trouble, either with the bearing, the screws or the cross-feed gear on the screw.

To bring the tool block back after the roller has pushed it forward I put quite a stiff spiral spring on the rod used for tool-stop in screw cutting; this rod is marked *K* in the drawing.

The cam *L* on the shaft *F* is to give a side clearance to the cutters when required. The roller and stud are fastened to the carriage. This is used on wood cutters principally. Our arbors *M* are short for stiffness, and have a 3-16-inch feather, and the cutters are always a good fit. The driver is double ended, with two set screws, and is driven by two studs in the face plate, which are always set so that each does its share of the work. I show a roller and stud, Fig. 4; these are of tool steel, hardened and ground. In getting up this attachment great care must be exercised to have the stud holes in roller head *B* spaced accurately and at equal distances from the bearing surface of *B*.

GEO. H. FRIZZELL.

Chicago, Ill.

Fig. 4.

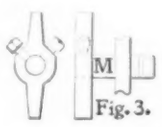

Fig. 3.

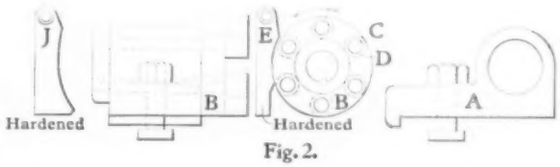

Fig. 2.

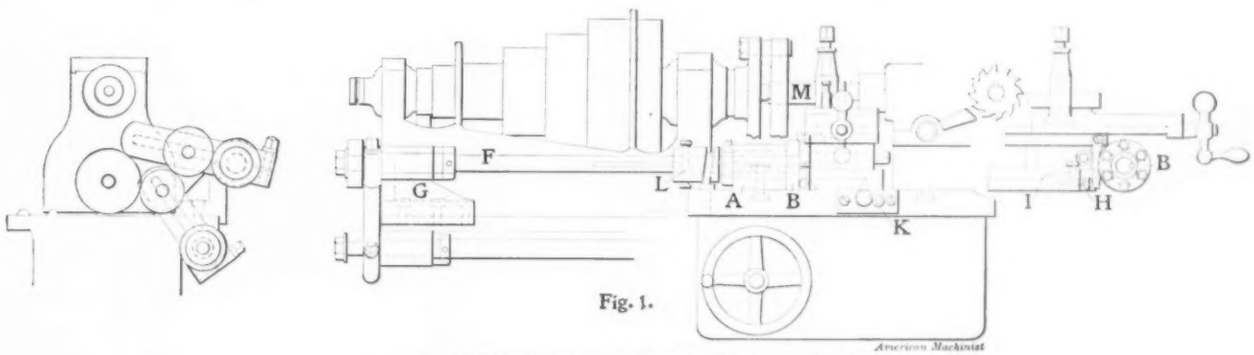

Fig. 1.

A BACKING-OFF ATTACHMENT FOR A LATHE.

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The Machinists at Fault.

Editor American Machinist:

Mr. McCarthy's points in your issue of December 1 are not without merit, but are yet open to discussion. The flange on the countershaft cone is not an unmixed blessing by any means. The belt is very apt to climb onto it, and this, I believe, is one of the chief reasons for its abandonment. It is not so very many years since they were usual. This trouble is usually guarded against on the head stock cone by fitting guards or fenders. In most cases a fender could be fitted alongside the upper cone and result in a great economy of mental labor to the poor, hard-working lathe hand. And there are also other methods.

Regarding the tailstock clamp his objections are valid, but I do not just now recall any more satisfactory rig.

His objection to the feed belt is well grounded; but how many machinists are there who will constantly try to get any more out of a tool than the aforesaid belt will drive? I have eight or ten up-to-date, well-built modern lathes, all provided with geared rod feed and most of them with the belt drive also, but I have hardly ever yet got hold of a workman whom the finest feed on the tool would not satisfy if somebody did not follow him up; and as for changing over to the gear drive because the belt was too weak—such a thing never seems to occur to him.

I have got tired spending money for tools intended to increase output and never get any return, and there are plenty of shop managers or superintendents in the same boat. Output depends on the man as well as on the tool. The majority of machinists do their work just as they did it twenty-five years ago, and the improvements in machine tools, steel and appliances go for little.

My idea of the operation of a machine tool is that it should always and at all times be made to do all that it is able to do. I believe that is what they are for.

I will be glad to make room for men who cannot get work enough out of the

machines to suit them, and will guarantee that they will find a lot of tools that will satisfy the most exacting. A lathe or any other machine tool is simply a means for doing the greatest amount of work in the least possible time, and not for providing an arm rest for strolling machinists. "Good work and lots of it," the bluff so many applicants put up, usually turns out to mean run the machine so as not to hurt anything and use the finest feed possible until the foreman catches you; botched fits, a tool board full of undressed or unground tools and a machine as dirty as possible. A light, clean, warm, airy shop, with the best of sanitary appliances, the best tools and equipment money can buy, one would think would inspire some feeling of ambition, especially when accompanied by steady work and good pay; but I grieve to say the number of men on whom this is all lost is incredible. These seem like hard words, but unfortunately they are true, and as a machinist of many years' standing, and with a keen appreciation for a man with the true mechanical instinct, I say them with the hope they may not be unheeded.

SUPERINTENDENT.

▲ ▲ ▲

Rig for Boring and Keyseating on the Lathe.

Editor American Machinist:

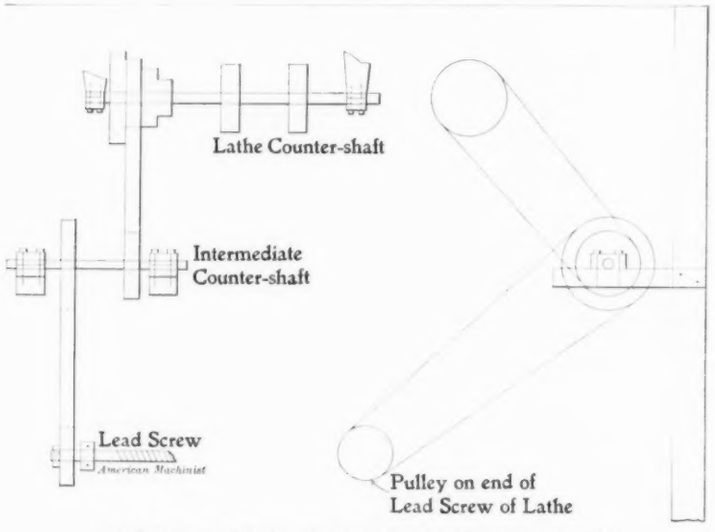
To make a success of keyway cutting or slotting rapidly in the lathe it is very necessary to have a rigid tool and the carriage well gibbed down. I use my toolpost boring bar for both boring and keyway cutting. It works so well that I thought the idea might be of service to others.

A solid block of iron is planed with a tongue to fit the groove where the toolpost goes, and on the top and toward the center line of the lathe a V is planed, so that the center of a 1½-inch octagon bar will come level with the lathe centers. For a smaller sized bar I insert a piece under it to bring it up to the level. These bars are turned 3 or 4 inches on the end, and also slotted near the end for ¼ or ⅜ inch self-hardening steel, which is held in place by a key. The bar and block are held to the carriage by bolts passing through the blocks, and which have heads fitting the toolpost slot. A lever clamp holds the bar down, the long end of the lever being tightened by a set screw bearing on a projection of the block. This makes a boring bar rig that is all right. When the bar is clamped it can neither turn around in the V nor swing sideways. With a double ended cutter I can readily take at one cut ¾ inch in cast iron on a 25-inch lathe.

I do all my keyway cutting without removing the work from the chuck, with the same bar as for boring, merely changing the cutter. My arrangement for slotting by power is very simple. I put up an intermediate shaft back of the lathe on the wall. I run a belt from the cone pulley of the lathe countershaft to this intermediate shaft, which is long enough to have a pulley on it in a line with a pulley on the lead screw of the lathe in place of the gear. The lathe belt is left hanging loose on the smallest step of the countershaft cone. To work the rig, turn the chuck and the work around to where you want the keyway cut, throw in the back gear to hold it there, close the lead screw nut, and you are ready to do a good, quick, straight job of keyway cutting, using the lathe countershaft friction clutch shifter to work the lead screw back and forth, it being speeded to cut as fast as the tool will stand. My backing motion is double the cutting motion. I use the cross screw of the rest to make the taper of the keyway, and after a little practice I find that I can make as good a taper as any keyway cutting machine. For mower gears it does not take over three minutes to insert the tool and cut the keyway. The slot is straight with the hole. There are no belts thrown on or off, except the lathe belt, when doing a contract of boring and keyway cutting. For a little contract shop in the country, where there is no slotter nor keyway cutter, this arrangement is very satisfactory.

WM. H. RICE.

Bakersfield, Cal.



RIG FOR DRIVING LEAD SCREW FOR KEYSEATING.

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Paying for Machine Work by Area of Tooled Surfaces.

Editor American Machinist:

I understand that some of the shops in Great Britain are run upon a system of paying for tooling surfaces by superficial areas, *i. e.*, by the square inch, or foot, the prices being graded in accordance with the character of the work. I have been trying this plan, and as foreman of a shop in which locomotives are built have figured piecework prices on feeds and speeds. For instance, a main frame of a locomotive. Our frames at present are 27 feet 10 inches long and 31 inches wide. We have a 36x30-inch Sellers planer and are running it 21 feet per minute. I found what feed it would take running two tools, and it was then a small matter to figure the time it would take to finish the frame, using my best judgment as to the length of time required to set up the job. I have several jobs for which I pay 1-5 of a cent per square inch, and I find it comes out about right; that is, for planing and turning. Our men make 30 cents per hour drilling. I pay ¾ of a cent for a 1-inch hole 1 inch deep in cast iron; in steel, 1 cent for the same hole; that is, for a job that has about 50 or 70 inches in it. This will not hold good on a job that has 150 or 200 inches of drilling in one setting; I do not pay as much for a job of that kind.

Drill press hands we pay 20 cents per hour; that is, we allow them to make that if they can.

This is a start at least toward doing what is declared to work well elsewhere, and it has so far worked satisfactorily to all concerned here, where I have tried it. I should like to know something of the experience of others with the plan, if there are others who have tried it.

MACHINE SHOP FOREMAN.

▲ ▲ ▲

Fixture for Grinding Profile Cutters and Laying-Off Cams.

Editor American Machinist:

The accompanying sketch shows a device for grinding profile cutters and laying-off cams as it has been built, in slightly modified form, for the Warder, Bushnell & Glessner Company, at Springfield, Ohio. It should be understood that this is a sketch and not a working drawing. It serves only to illus-

trate the principle of this device and not the precise construction.

The cutter to be ground is held on an arbor, which, in turn, is held in a graduated sleeve, in which it may rotate. The sleeve is clamped in the holder *A*. This allows of adjustment for cutters of varying thicknesses. The common spring-pawl arrangement is used to bring each tooth in its turn up against the emery wheel. The lower portion of the holder *A* forms the slide *B*. *B* slides in *C*, and *C* slides over *D*, while *D* again swivels on *E*. *E* consists of two parts, and forms what I call the floating platen. This floating platen is the essential part of the apparatus, as will be seen. It is circular in form, and can move in any direction over the disk *F*. In the sketch this disk *F* is shown to be sawed in, and with a slightly raised outer edge, so that the tightening screws *G* will clamp the floating platen to the disk. *F* is bolted to the lower plate *H*, and pivots around *I*, which is a part of the slide *J*. *J* finally slides over *K*, which is bolted to the table of the grinding machine.

The different slides are provided with micrometer screws, and the swivels are graduated. Fig. 2 shows how the cutter holder is fastened to the bottom plate of the apparatus in another way than the one described. On top of the holder swivels a piece in which is clamped a rod *L*, which slides through a swiveling piece *M* seated on top of the rod *N*. This rod, or rather column, is rigidly connected to the bottom plate of the fixture.

If the floating platen is central with the disk *F*, and a point of the cutter is also over this center, then this point remains stationary, when the floating platen with the disk is revolved around *I*. But when the floating platen is not central with the disk, the point describes a circular arc, with a radius equal to the distance between the centers of the floating platen and the pivot *I*. Now, in order to make this distance any required amount, the top part of the apparatus is held in position by clamping the swiveling piece to the column and the horizontal rod to the swiveling piece. Then the pivot *I* is brought forward or backward the required amount, by means of the micrometer screw in the bottom plate, and the floating platen is clamped to the disk *F*; after which *L* and *M* are released, and the cutter is turned the required number of degrees, and thus any number of curves may be described within the range of the machine.

To better understand the action of this swivel *D* has been turned. a pointer or pencil instead of the emery wheel and a piece of metal or paper in the holder instead of a cutter. Suppose the pointer is at *a* (see Fig. 3). The center of the pivot *I* is at *b*, and the center line of the screw which moves *I* is represented by *x y*. As the pointer *a* is over the center of the floating platen, this pointer describes the curve *a b*, when the floating platen and disk *F* are swiveled around the pivot *I*. Now the center line of the screw which moves *J* has taken the position as indicated by *x y*. That is to say, this center line has kept its original position in relation to the machine, but it has taken its new position in our diagram. Suppose we turn the screw in the slide *K*, after clamping the upper structure and unclamping the screws *G*, until the center of the pivot *I* has reached the new position *O*. If now we unclamp the upper structure and clamp the screws *G*, then, by swiveling around *I*, we can make the pointer describe the curve *b c*, and so on.

In order to describe straight lines we move the upper slides *B* and *C*. Moving *B* will produce a straight line parallel with the center line *x y*, and moving *C* will produce a straight line at right angles to that center line, provided the slides are in the position as shown in Fig. 1. If, however, the swivel *D* is turned a certain angle, then a movement of either of the slides *C* or *D* produces a line at an angle with the center line, the angle depending on the number of degrees the pointer can describe any number of circular arcs and straight lines within the capacity of the machine, and with an accuracy dependent only on the accuracy of the apparatus. By substituting a pointer for the emery wheel, and by holding a piece of metal in the holder *A*, the cams may be laid off with extreme accuracy, such as cannot be attained by even the most skillful and sensitive hand. It will now be readily seen how, with this

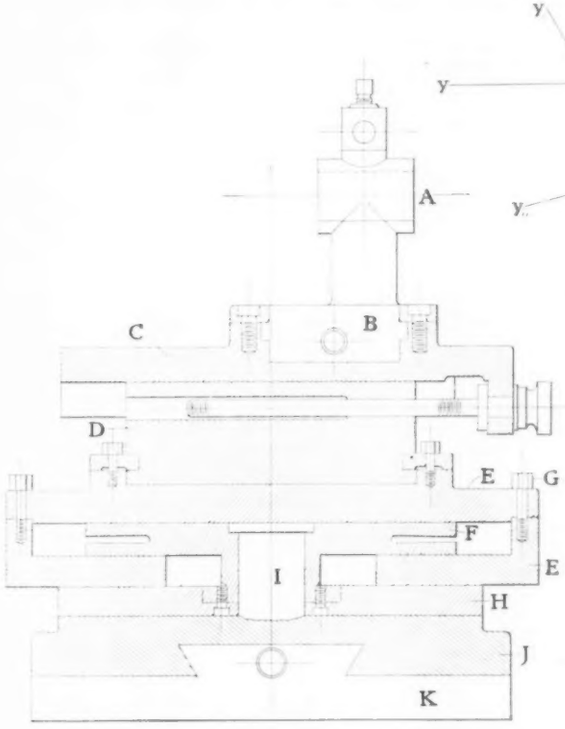


Fig. 1.

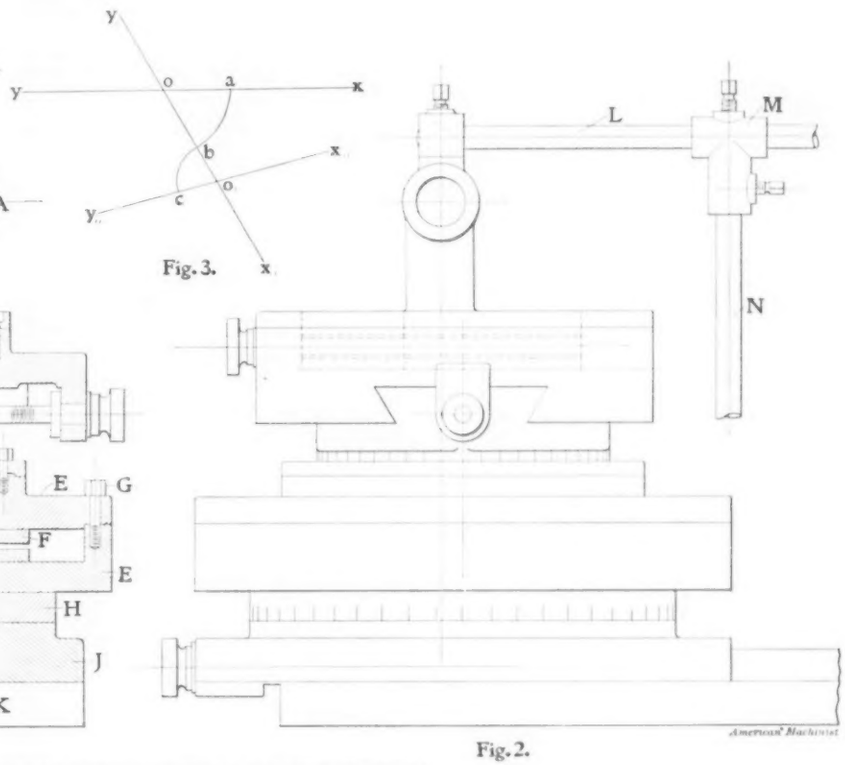


Fig. 2.

Fig. 3.

FIXTURE FOR GRINDING FORMED CUTTERS.

apparatus, any profile cutter can be ground to its true shape.

Instead of the micrometer screws, a hand lever may be used for moving the slide, while a micrometer screw may be used to adjust a stop for limiting the motion of the hand lever.

A. L. DE LEEUW.

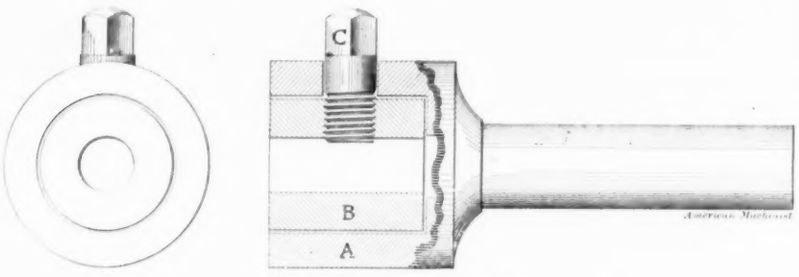
Hamilton, Ohio.

▲ ▲ ▲

Holder for Reamer in Turret.

Editor American Machinist:

I inclose a sketch of a holder fitted for a turret lathe in brass shop practice. This



A HOLDER FOR REAMERS.

holder is intended for parallel reamers, where accuracy is paramount, such as for injector nozzles, etc. In an experience of nearly thirty years in the brass shop I have found that the common method of using these reamers is to place a small dog on them, using a center in the back head, holding the dog in the left hand and driving it through with the right. In this way the reamer will not cut larger than its own diameter, as it is liable to do if held rigid in the ordinary socket.

This method is all right in its way, but there are two things liable to happen if the reamer should leave the center during the operation. First, the reamer will snap and break, or, second, the operator s hand will be badly bruised or torn, as a scar on my own hand can testify; hence the birth of this idea, and I am under the impression that it is original, as quite a number of old-time "brassies" have told me that they have never seen or used anything like it, notwithstanding the fact that our "smart Aleck" says that it is as old as the hills, and has been discarded long ago.

This stock consists of three pieces—*A*, the stock proper; *B*, a loose sleeve or collar, tapped and fitted with a set screw *C* for holding the reamer. The business end of this stock is 2 inches in diameter, with a bore of 1¼ inch, to a depth of 1½ inch, and a bore through the shank, suitable to clear the shank of the reamer. At right angles to the 1¼-inch bore, and about one-half of its depth, a hole is drilled (but not tapped) to slip in the set screw *C*, with 1-64-inch play. The diameter and length of the sleeve or collar *B* are 1-64 inch less than the bore and depth of the stock *A*, with a suitable bore to fit the reamer shank, say, 9-16 inch, or thereabouts. The holder can then be set rigid in the turret with the other tools, and the reamer will have the benefit of the play, between the bore of the stock and diameter of the collar, thereby insuring a hole no larger than the reamer used, and a certainty of keeping one's hand intact. E. J. W.

[Where the turret holes are liable to be out of line with the spindle this is undoubtedly better than the old-fashioned way; but it would be still better, it seems to us, if there were two bearing points instead of the single screw to take the twisting force. We have illustrated devices in which the reamer rested upon the point of a center fixed at the bottom of the hole in the holder and with its shank loosely held and prevented from turning by suitable pins. Some such device is considered necessary where good screw-machine work is done.—ED.]

▲ ▲ ▲

A Tool Protector for Planing T Slots.

Editor American Machinist:

With the ordinary solid planer tools it is a matter of considerable trouble to plane out T slots, as the constant attendance of the operator is required to lift the tool on the return, or backward movement of the platen and to drop it again as the forward movement is about to begin, broken tools, spoiled work and profanity being often the result. The device herewith illustrated becomes, therefore, not only a useful mechanical accessory, but a moral agent as well. It is not by any means new. There may be some readers who have not seen the device, and still others who have forgotten it, and who need to be reminded of its practical value. It is not presented for the benefit of the man who "made a thing just like that and used it thirty odd years ago."

The device consists of a jointed bar *A B* placed in the rear of the planer tool and clamped in place with it, as shown in Figs. 1 and 2. For a planer tool made of ¾x1½-inch steel this bar may be ½x1¼ inch, and say 9 inches long, the lower piece *B* being about 2 inches long, the two being joined, as shown in Fig. 1, by a steel pin 3-16-inch diameter. The joint should be fitted quite loosely.

Upon the forward or cutting movement of the planer table the jointed piece *B* trails behind the tool, as shown in Fig. 1. As soon as the tool is well out of the cut the piece *B* drops to a vertical position. On the backward stroke *B* forms a shield for the tool, preventing it from entering the slot which is being planed, and raising the tool, as shown in Fig. 2, where it rides in safety till the end of the work is reached, when it again drops into position for the cut.

In planing large T-slots the planer may be left to run for some time without attention and with no danger of the tool being caught and broken. Of course it is necessary to see that the clapper-box is not fitted so closely as to prevent the tool from dropping into place at the end of the backward stroke, and to put a weight on the tool to insure safety in that respect if it is needed.

OSCAR E. PERRIGO.

New Haven, Conn.

[A device similar to this, but not quite so well arranged, was shown in these columns about ten years ago.—ED.]

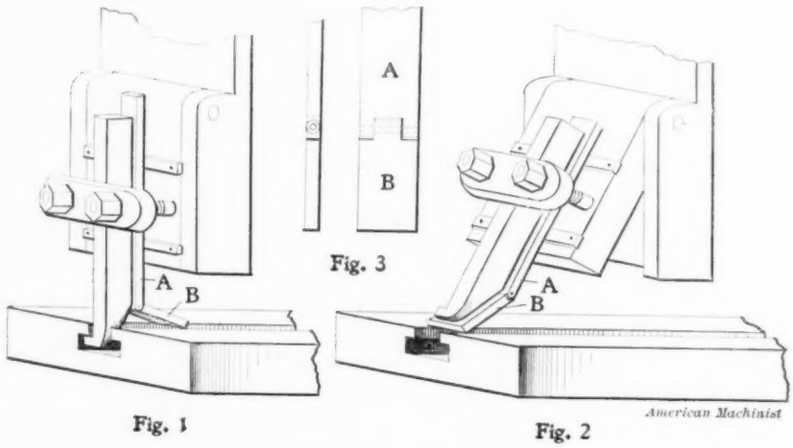


Fig. 1 Fig. 3 Fig. 2

TOOL LIFTER FOR PLANING T SLOTS.

Two or Three Lathe Jobs—Making Packing Rings—Turning a 30-Inch Double Seated Butterfly Valve.

Editor American Machinist:

I send you sketches of two or three different jobs that may be of interest to your readers. The first, Fig. 1, is a device for slotting screw heads which I have just designed and which has not been put into use yet, but there would seem to be no reason why it should not be a howling success. The special angle plate *a* is secured to the rest in place of the toolpost. The revolving plate *B* is slotted on the edges for the diameter of the screw to be held, as shown at *c*, and the screw is held in the plate or holder by the spring clips c^2. The spring clips are made by slitting a steel disk made to fit holder, as shown, and fastened to the same by flathead screws after slitting it according to the number of screws to be held.

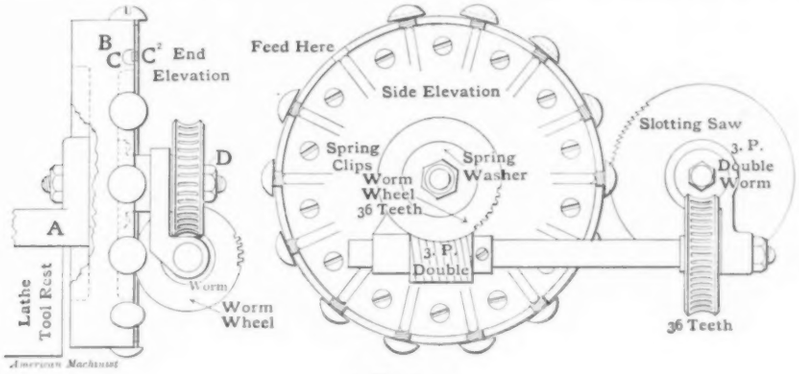


Fig. 1.

RIG FOR SLOTTING SCREW HEADS.

The clips are bent inward slightly and tempered, the whole disk being given spring temper. The saw is held between the centers of lathe, and on the same arbor is a worm which actuates a worm wheel, which in turn actuates a worm and worm wheel on the other end of the shaft, thus providing a circular feed for the holder. The end nut *D* has a spring washer under it to secure steadiness of motion. The screw holder is fed at the vacant place shown, and the boy in charge removes the slotted screw with one hand and inserts another to be slotted with the other hand.

The other edge of holder *B* can be made to fit another size screw, and be reversible. It is calculated to slot about 7,500 screws per day.

The method here described for turning piston rings I have actually practiced. The casting from which the rings are to be turned being properly secured to the face plate, Fig. 2, take a roughing cut on the end and outside of the casting to get under the scale. Bore the inside to within 1-32 of an inch of the finished size and then finish the outside to size. Use two cutting-off tools, fastened as shown, setting the tools to finished width of the rings + $\frac{1}{64}$ inch. Run the tools in until they begin to bulge through a little. Practice will enable one to determine this depth. Then take two tools half way between a cutting-off tool and a side tool, giving the front ends a little angle, and the cutting corner the farthest ahead. Set them the correct distance apart, by a gage tried between them, and then feed them in to the same depth as the cutting-off tools. Remove these tools and insert the boring tool. Bore to the finished size and the rings will drop upon the boring tool. This is a good way to make cheap parallel strips for shop use. The eccentric rings are made by removing the scale from bore and outside and end, then finishing the outside to size, setting over the required distance and reboring of 1-32 inch less than size, the balance of the work being then the same as for the concentric rings.

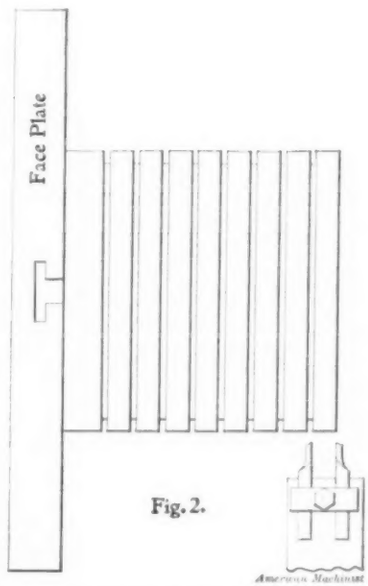


Fig. 2.

TURNING PISTON RINGS.

The centering of this object, Fig. 3, is a somewhat difficult job. The center line of the square hole for the shaft must be at right angles with the center line of the lathe. When the axis of the shaft hole is in a vertical plane the centers on lugs should be in a horizontal plane, and the centers must be at such an angle as will permit you to take at least ⅛ inch off all round. The best way is to lay them off on a planer bed, center them small, prove between centers of lathe, and when correct ream the centers to good size and drill small holes for bottom clearance. The lugs *a* are cast to drive by. The first operation is to turn one seat, as shown, then change to the other centers. The diameter can be calipered across the middle near the shaft hole. Turn the valve 1-64 inch less than the diameter of the casing. The center around shaft hole must be relieved a little with a file to enable valve to rotate in the casing.

These valves are designed to close by pulling a lever on the end of the shaft in either direction, and are used around blast furnaces to shut off the air blast. There were a great number of small butterfly valves for sawmills made about the time when I was a cub, and I thought when I could turn them I was all right; but I never thought I would run up against a 30-inch one with two seats. R. SAFELY.

New Orleans, La.

▲ ▲ ▲

"The Engineer," London, says: "It is said that the bicycle season of 1899 will see the introduction into this country of a 'fifteen-dollar' machine by one of the largest manufacturers in the United States. What next?"

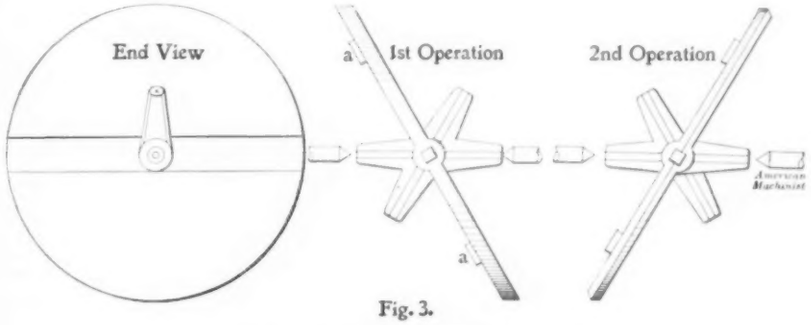


Fig. 3.

TURNING A BIG BUTTERFLY VALVE.

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For the Coming Year.

The present number closes the twenty-first volume of the "American Machinist." Reaching our readers as it does about half way between Christmas and New Year's, it is in order for us to extend the compliments of the season. We hope every reader found in his stocking or elsewhere the inspiration to be merry and that the coming New Year will be prosperous for every one.

As to what the "American Machinist" will do for the coming year, we can say only that it will keep on about as heretofore and that we shall continue to publish the best matter we can get hold of that relates to shop practice and machine construction. In doing this we shall spare no reasonable expense or pains, and shall, during the coming year, publish quietly and as a matter of course better articles than are sometimes heralded with much blowing of trumpets and sounding of hewgags.

We are pleased to say that we have abundant, substantial and satisfactory evidence that our efforts have met with the hearty approval and support of the machine trade generally, though this does not lead us to make the mistake of considering the paper perfect or beyond the possibility of improvement. On the contrary, we shall take every opportunity of improving it.

We now have in course of preparation and "in sight" articles which we think will of themselves make the coming volume a notable one, to say nothing of the many good things that will naturally be evolved during the year by our able contributors and by those whose lot it is to devote their entire time to that purpose.

All that is best worth knowing regarding machine shops, their equipment and product, here and abroad, will be presented.

Among the other notable articles will be a series on the principles of machine-tool design by John Richards; articles giving drawings and full particulars of a modern machine shop—the building and its internal arrangement and equipment; one or more articles fully illustrating and describing a recently completed machine shop, which is believed to be the most elegant and most highly developed establishment of the kind in the world; while our regular contributors will continue to help us in making the paper indispensable to machinery men.

▲ ▲ ▲

Who Will Conduct the Machine Tool Trade?

In its issue of December 15 the "Iron Age" speaks of changes that have taken place and are to be made in the machine tool trade that will "affect the trade generally throughout this country," some of which changes our contemporary, with just a shade more of pomposity than the circumstances seem to justify, says "we are in a position to announce * * * authoritatively to the trade."

The "announcement" is evidently inspired by Manning, Maxwell & Moore, and amounts to a declaration on their part that they intend to dominate the selling side of the machine-tool business in this country, and so arrange that tool builders will eventually be entirely cut off from all intercourse with tool buyers and users. This is shown by the language of the following quotation from the article referred to: "The general plan on which M., M. & M. are working is an innovation in the machine-tool business in this country. It tends toward advancing the sole agency system, and treats the manufacturer as one distinct factor, attending entirely to the turning out of his product, while the selling of this product is left entirely to a concern who handle [*sic*] the sale of this product."

After a lot more of bombastic talk, a list is given of twenty tool building concerns "for whom M., M. & M. are the sole representatives in the Chicago and Northwestern district."

As we are interested and think many of our readers are also interested in knowing whether this "innovation in the machine-tool business in this country," by which manufacturers of tools are to be retired and barred out from the commercial side of the business, is really taking place or not, we wrote to twelve of the concerns named and have replies from eleven of them, including all the more important ones. Barely two of these replies confirm the report as to an exclusive agency in the territory named, and all the others state that the report is either only partially true or not true at all.

So those of our readers who may prefer to keep control of the selling end of their businesses and who may possibly have become alarmed at this "announcement," and what it seems to portend, may rest easy. This effort to control the selling end of the machine-tool business is not the first one that has been made, and we have good reason to believe that the present effort, though carried on with considerable boldness, we must admit, will not succeed in anything like the degree indicated by our esteemed contemporary. The bulk of the machine-tool business of this country will, we believe, continue to be conducted by the men whose genius and ability have built it up to its present magnificent proportions, and the experience of the comparatively few who have tried the plan of leaving their market entirely in the hands of others, very plainly teaches the unwisdom of that plan. The pronunciamento is simply laughed at by those who know the tool business.

▲ ▲ ▲

R. E. Howard a Fraud.

With the best kind of recommendations from responsible parties in London, we some two years ago appointed R. E. Howard, of 9 Finsbury square, London, E. C., our subscription agent in Great Britain.

Howard immediately began to do a large business and established a credit that soon allowed him to get into our debt some hundreds of dollars.

We would not complain publicly of his defrauding us if the consequences were to be borne by us alone. Months ago we took his name off our published list, as agent, yet many British firms continue to send him remittances for subscriptions; some of these he has sent in and some he has not. Howard owes many American publishers and small toolmakers, and is, so far as we can learn, making no effort to settle.

Readers of the "American Machinist" are warned against sending any money to Howard on our account. He has not represented us for months, but has an old receipt book that he uses.

We will honor subscriptions paid to

Howard previous to the publication of this notice.

Remittances through Sampson, Low, Marston & Co., St. Dunstans House, Fetter Lane, London, E. C., or William H. Smith & Co., 186 Strand, London, have always reached us.

AMERICAN MACHINIST PUBLISHING CO.

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A Misfit Assignment for an Engineer.

A well-known chief engineer of the navy, who doesn't have to take any dust from General Shafter in the matter of avoirdupois—tipping the scales, as he does, at a trifle more than 300 pounds—was recently ordered to take charge of the mechanical department of one of the smaller gunboats on the Pacific Station. The engineer didn't particularly like the assignment, but it didn't worry him to the point of suicide. He simply sat down and made a sketch of the exceedingly narrow doors that lead into the engine room of the gunboat to which he was ordered, marking the dimensions of the doors in figures on the sketch. Below his drawing of one of the engine room doors this jolly chief engineer made a neat sketch of himself, full figure, not exaggerating his Falstaffian paunch a trifle. He attached his own dimensions in feet and inches, circumferentially, to this sketch of himself. Then he put the sketches in an envelope and "respectfully submitted" them to the Bureau of Navigation. It was a sort of document that occasionally makes a hit. The inference to be drawn from the sketches was so obvious—the impossibility of the chief engineer's passage through the engine room doors of the ship to which he was ordered was so apparent—that the assignment was recalled, and the laconic chief engineer is liable to get a flagship when the next batch of steam engineering assignments is made.—Washington Post.

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The Largest Passenger Steamer.

The steamer Deutschland, now building for the Hamburg-American Line at the Vulcan Yard, at Bredon, near Stettin, will be the largest of passenger steamers. The vessel has a length of 663 feet, a breadth of 67 feet and a depth of 44 feet. In order to be able to appreciate those dimensions, it may be mentioned that the Pennsylvania, belonging to the same line—which, when completed, was the largest steamer then afloat—has a length of 560 feet. When fully loaded, and her bunkers filled with 5,000 tons of coal, the Deutschland will have a draught of 29 feet. She will be fitted with two six-cylinder quadruple expansion engines indicating in the aggregate 33,000 horsepower. The engines of the Deutschland will, consequently, be twice as powerful as those of the Fürst Bismarck, and six times as powerful as those of the Pennsylvania or the Pretoria. For supplying steam to the engines 12 compound boilers, with 8 furnaces each, and 4 single boilers, with 4 furnaces each, will be provided. There will thus be 112 furnaces to feed in the stokeholds of the vessel. The boilers are to work at a pressure of 15 atmospheres. The speed contracted for is 23 miles an hour, but it is expected that 25 miles will be reached. For the electric lighting of the Deutschland five dynamos will be provided, and the vessel will be equipped with 26 lifeboats, 18 of steel, 2 of wood and 6 collapsible boats. The steamer will be launched in about six months' time, but it is not expected that she will be ready for service until 1900.—London Times.

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Manufacturers Discuss Taxation.

At a recent meeting of the Manufacturers' Association of Brooklyn, Thomas G. Shearman and Lawson Purdy made addresses on a bill to be introduced in the New York Legislature this winter allowing counties in the State to decide for themselves whether direct taxes within their limits shall be upon the value of real estate alone, or upon the assessed value of personal property alone, or upon the assessed value of land alone, exclusive of improvements and personal property. The association voted in favor of the bill, which, it is believed, will enable counties in which large manufacturing interests are located to relieve some unjust burdens of taxation now laid upon them without injustice to other interests, at the same time leaving agricultural counties to make their assessments in the manner best suited to their interests.

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Technical Publications.

FOWLER'S MECHANICAL ENGINEER POCKET BOOK. By Wm. H. Fowler; 324 3¼x6 inch pages with 22 illustrations. The Scientific Publishing Company. Price 1s. 6d.

This is another of the class of English pocket books which we have noticed from time to time, and of which the distinguishing feature is the value of their contents combined with an astonishingly low price. This book is well printed and well bound, and is packed with well selected tables and data, while the price in England is only the equivalent of about 35 cents of our money. This low price is due to the inclusion of a large number of advertisements, and while the user may be disposed to resent their presence in such large numbers, it is only by their presence that the price is made possible.

There is no class of books which it is more difficult to compare, as regards the usefulness of their contents, than pocket books. Nothing short of actual use will develop their shortcomings, and the merits of a pocket book are largely of a negative kind, and are in inverse proportion to the book's defects.

It may be said that the present book is extremely compact, this result being obtained by entirely abandoning the attempt to make it in any sense a treatise on anything. There is no derivation of formulas and very little discussion of any kind, the truth of all standard formulas being taken as already established, and only such results as are useful being given.

A criticism made in a recent notice of another English pocket book may be repeated here. In this entire book we are unable to find so much as a mention of the diametral pitch system of gearing, while the rules for the strength of gearing are hoary with age. Obviously, some of our English cousins have still to learn the advantages of diametral pitch, and that the teeth of a twelve tooth pinion are not as strong as those of a rack of the same pitch.

WHAT SHALL OUR BOYS DO FOR A LIVING? By Chas. F. Wingate. 287 4½x7-inch pages. Cloth. Doubleday & McClure Co., New York.

Though this is not really a technical book, it treats of subjects in which many of our readers are specially interested, aside from the general interest which every father of a boy, and every boy himself, must feel in the problem stated by the title. The book can scarcely fail to be very helpful to those who, either for their sons or for themselves, must study this problem, and we know of no other publication in which so much information regarding so many different occupations and professions can be found. Much good advice is given, not only bearing upon the choice of a lifework, but as well upon the peculiar qualifications which must be either originally possessed or cultivated and developed in order to reach the highest degree of success. In dealing with the engineering profession the author quotes from "Chordal," and gives the familiar account and experience of his boy "Joe," the same author being also quoted in other parts of the work, which is in fact replete with apt quotations and with accounts and experiences of men who have been successful in nearly every avocation. It is, we think, pretty certain that nearly every young man would be benefited by reading this book carefully before choosing his life's work.

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By the courtesy of Mr. C. W. Hunt, ex-president of the American Society of Mechanical Engineers, we are favored with a copy of his presidential address, delivered before the society, and which we have previously published an extract from. We understand that anyone who desires a copy of this address may ob-

tain it by addressing Mr. Hunt, 45 Broadway, New York city.

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It is stated that a firm in Stuttgart, Germany, is making beer wagons propelled by motors and that a Berlin brewer has adopted this wagon.

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Personal.

Mr. E. W. Irwin has resigned as manager of the New York office of the Pratt & Whitney Company.

Will the correspondent who wished information regarding the manufacture of tubes for paints please send his address to the editor?

Mr. William B. Murdock, who for over two years has been traveling in Europe representing the Pratt & Whitney Company, of Hartford, has returned, and expects to remain in this country now for a while at least. He will travel here for the same company.

Mr. George Simpson, who for something over four years has been with the Farrel Foundry & Machine Company, of Ansonia, Conn., has returned to the Robert Pool & Son Company, of Baltimore, with whom he was formerly engaged for nearly thirty years.

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Inquiries for Machinery.

Those who make, or may know of the makers of such machinery as is called for below, will oblige us by sending name and address, mentioning the number of the inquiry. We cannot forward catalogs. We have inquiries as follows:

82. From Germany, for lathes to turn rolls used in paper machinery.

83—For machines to make small wax tapers, such as are used for lighting gas jets.

84—For names of makers of file cutting machines.

85. Machinery for making carbons for electric arc lamps.

86. Machinery used in galvanizing metals.

87. Makers of machinery used in the manufacture of electric cables having from 1 to 100 conductors.

88. Makers of an automatic foot-power skate-grinding machine on which an emery wheel is used.

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When the United States cruiser New York was at Kiel, various tests or exhibitions of her machinery were made for the gratification of the German Emperor. Among the things done was the coupling and uncoupling of the engines, the complete operation occupying two minutes and forty-five seconds. It has since been ascertained that on the British cruiser Blake it takes thirty-three minutes to do the same.

Obituary.

Stephen A. Morse, whose name will be remembered by every mechanic in connection with the Morse twist drill, died in Philadelphia December 22, seventy years old. Mr. Morse was born in Holderness, N. H., learned the machinist trade and became a successful and prolific inventor, the twist drill being only one of many of his devices. He settled in Philadelphia about twenty-five years ago, and twenty years ago he became the founder of the well-known elevator firm of Morse, Williams & Co. Mr. Morse had for seven or eight years been afflicted with blindness, the result of an attack of the grip. His son, Edwin F. Morse, is now president of Morse, Williams & Co., and another son is also connected with the business.

Alexander Nimick, president of the well-known steel firm of Singer Nimick & Co., died at Pittsburg, Pa., December 20, seventy-nine years old. Mr. Nimick was wealthy, and was an officer of many important manufacturing and financial corporations.

Eben A. Baldwin, a member of the firm of Davis & Furber, the well-known builders of textile machinery, North Andover, Mass., died December 21, forty-nine years old. His connection with the Davis & Furber Works began when he was nineteen years old, and he had been with them continuously.

Charles Hillman, president of the Charles Hillman Ship & Engine Building Company, of Philadelphia, died in that city December 22, seventy-five years old. Mr. Hillman was originally, and for many years, a builder of wooden ships, his firm having begun the building of vessels of iron and steel as recently as 1891.

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Foreign Orders for Locomotives.

Only a month ago we noted the fact that the Baldwin Locomotive Works, of Philadelphia, had just completed the first locomotive ever built by them for England. It is now announced that the Midland Railway Company has ordered of the same firm ten heavy freight locomotives. Ten mogul engines have been ordered also by the same railroad of the Schenectady Locomotive Works. English dispatches attribute the placing of these orders to the delay in production caused by the late great strike of the "engineers." The Schenectady Works, by the way, have just completed a shipment of twenty-seven locomotives for the Nippon Railway, of Japan.

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Fourteen locomotives, built at the Baldwin Locomotive Works, are being loaded upon the British steamer Glendowe at Philadelphia, to be transported to Novorossisk Russia, for the Russian-Siberian Asiatic Railroad. A number of men from the works go along to put the engines together and start them at work.

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Instead of Cincinnati, which was spoken of as the place for the next spring meeting of the A. S. M. E., Washington will be the place.

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Experiments as to the porosity of steel plates have been made at the Washington Navy Yard. Pieces of sheet steel ¼; ⅛, 1-16 and 1-32 inch in thickness were subjected to a water pressure of 6,000 pounds per square inch, and in neither case was any percolation found.

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In two public school houses recently built in St. Louis the chimneys are cast iron pipes built into the brickwork, one 60 feet and the other 85 feet high. The pipe is made in 6-foot lengths, 1¼ inch at the bottom and gradually reducing toward the top. The lower end of each section is bell mouthed, sitting over the smooth end of the pipe immediately below it, no cement or fastening being required. It is claimed for the cast iron pipe that it will last very much longer than the usual sheet metal construction, and that it will therefore eventually be much cheaper.

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Business Specials.

Gear wheels, gear cutting, Grant; see page 16.

Forming Lathes. Mer. Mach. Tool Co. Meriden, Conn.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

For Sale or Rent—Foundry and machine shop with additional land, in good condition and well equipped for medium heavy work; capacity of foundry 7 tons per day; located on railroad within eight miles of New York; terms easy. Call or address J. F. Sweasy, 26 Nassau street, New York

Complete set American Machinists, 1877 to 1898, for sale; first 18 vols. bound in morocco, uniform in style (binding alone cost $4.75 per vol.); 1897 vol. 19 in cloth; 1897 vol. 20 includes advertising, and is in leather; 19 volumes have name of private individual on side; will sell the twenty volumes complete for $100. Address Volumes, care AMERICAN MACHINIST.

Notice—An experienced and competent designing draftsman, prac. mach., has a proposition to offer mach. mfg. concerns that are equipped and situated for manufacturing marine oil engines; convincing proofs of reliability furnished. Box 177, AMER. MACHINIST.

NOTICE IS HEREBY GIVEN that the annual meeting of the stockholders of the American Machinist Press will be held at the offices of the company at No. 218 William Street, in the borough of Manhattan, City of New York, on Monday, the 9th day of January, 1899, at 12 o'clock noon, for the election of directors and the transaction of such other business as may properly come before the meeting.

New York, December 20, 1898.

CARL A. HANSMANN, Secretary.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Tool die maker, up in modern tools and dies, experimental work; A1 (capable). Box 168, AM. MACHINIST.

Mechanical engineer, tech. graduate, with office and shop experience, desires to change. Box 170, AM. MACH.

Foundry foreman, twelve years in one shop, had charge over 100 men, age 48, wants position, house or machinery; a hustler. Box 176, AMERICAN MACHINIST.

Commercial Review.

NEW YORK, SATURDAY EVENING, December 24, 1898.

MACHINE TOOLS AND OTHER MACHINERY.

The last week of the year finds the tool market strong and vigorous. The effect upon December trade of the approaching period of transition has been quite trivial. It is hardly necessary to say that the present year in the machine tool business has shown notable gains. An increase of 25 per cent. over 1897, or even more, would be a conservative estimate. The present activity of tool manufactories, although largely due to exports, is owing in a very perceptible degree to the growth of home trade. The strength of the market is evidenced by the continued firmness of prices. Advances on large lathes and planers have in some cases been made quite recently. Two Eastern companies, for example, have raised the prices on lathes of from 20 to 60 inches swing. Indications point most assuringly to a prosperous year, 1899.

The railroads are buying fairly well; they are busy throughout the country, and are entering the market for tools with increasing freedom. The Central Railroad of New Jersey is expected to give out orders for some $75,000 worth of tools if it concludes to build its projected new shops at Elizabethport, N. J., to replace those that were burned a few months ago. The M. S. Friede Company, New York, has for a considerable time past been purchasing materials for the new Trans-Siberian Railway, and we are informed that its orders from the local Niles Tool Works Company to date foot up hard on to $50,000.

The Niles Tool Works Company, New York, it is hardly necessary to say, although a branch of that at Hamilton, Ohio, has a separate executive organization and handles several lines of tools other than those of Niles make. It undertook to do this in order to be able to furnish complete equipments both of large and small tools, and this miscellaneous feature of the business has developed very rapidly during the last year or two. The sales of the New York branch of the Niles Company for the present year have been nearly double those of last. During the latter part of the year it has handled the product of the Pond Machine Tool Company, and this has been an important contribution to the total; but the increase has been large in the old lines.

The E. W. Bliss Company, prominent in press and die manufacture, continues to experience a great improvement in business, and the outlook for next year is excellent, projects being on foot which are expected to result in contracts for large quantities of machinery. The increase in demand at home is rather a re-

(*Continued on page 36.*)

Situations Wanted—Continued.

Tech. mech. draftsman; 4 y'rs' exp. Box 172, AM. MA.

Gas engine designer; change pos. Box 173, AM. M.

Wanted—Situation by reliable all round steel and iron forger; best references. Box 179, AM. MACH.

M. E., first-class dr'f'man, sp'ks Ger., 12 y'rs' exp. in d'sg'ng of elec. mach., esp. power & tract., & cur. con. apparatus, open for pos.; best refs. Box 183, AM. MACH.

Mech. eng. wishes to make a change in Jan.; 14 y'rs' exp, as f'man and supt.; tech. grad. and d'ftsman; fam. with shop ac. G. W. N., 584 Lafayette Av., Bklyn, N. Y.

A gentleman, 26, mach., 2 years Cooper Union night school. 2 1-2 years leading tech. university, desires sit. as salesman or in office, where energy, honesty and perseverance will gain adv'ment. Box 182, AM. MACH.

An expert in mfg., toolmaking and machine work, twenty years' experience, all classes, wants engagement; super. of all or foreman of either; up-to-date and alive; results guaranteed. Ad. Box 175, AM. MACH.

Draftsman, a first-class man, experienced in figuring strains for hydraulic and pneumatic work, laying out gearing, or on general machinery, wants situation; temporary or per.; $21 per week. Box 180, AM. MACH.

Experienced brass foundry foreman, desirous of making a change after January 1, would like to hear from parties requiring the services of an up-to-date hustler; first-class references furnished if desired. Box 181, AMERICAN MACHINIST.

Help Wanted.

Wanted—By a Western company a draftsman who has had exp. on air compressors. Box 174, AM. MACH.

Wanted—Competent salesman for machine tools; to the right party a permanent position is open; state ex. and pay expected. Ad. P. O. Box 12, Cincinnati, Ohio.

Wanted—Young mech. eng. of exp. to take charge of power and construction depts. in large mfg. plant; state ref., exp. and salary expected. Address Kodak Park Works, Eastman Kodak Co., Rochester, N. Y.

Wanted—A thoroughly experienced designer and draftsman who has had extensive practice on large Corliss engines and marine engines. Address, with references and full particulars, Box 452, Pittsburg, Pa.

Wanted—Superintendent; age about 40; modern practice; for building machine tools; require first-class, active man; all communications confidential; give full particulars stating exp. Box 154, AM. MACH.

Machinery salesman with established trade in presses, rolling mills and wire drawing machinery; position open January 1; first-class, experienced men only need apply; all communications will be treated strictly confidential. Box 155, AMERICAN MACHINIST.

Wanted—Patternmaker with knowledge of drawing; must be practical and competent to take charge of patternmaking and improvement department in agricultural implement factory in large town; good situation for the right man. Ad. Box 156, AM. MACH.

Wanted—A practical mechanic, with at least $5,000, to buy stock in an established machine shop and foundry doing a good business and capable of being doubled; the man must be competent to act as general super. of the concern. Pennsylvania, AMERICAN MACH.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper catalog free. E. G. Smith, Columbia, Pa.

Bock, Dies & Die Making, $1. J. L. Lucas, Prov., R. I.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Lt't and h'vy mchy., exp'l and sp'ly b'l't. mdrn. appl. and tls.; prices reas'ble. Wm. H. Baker, Trenton, N. J.

Plant wanted for producing bright round stock up to 2 1-4 in. in diameter. Full particulars and tender to Garrard, Ryland Street, Birmingham, England.

Manufacturers—I have simple exhaust valve operating mech., no gears, on royalty with pos. as draftsman. Automatic Gas Engine, Grand Rapids, Mich.

Parties near New York having for sale second-hand iron foundry fixtures, such as crane, flasks, ladles, etc., may find a possible purchaser by sending description to Box 178, AMERICAN MACHINIST.

Wanted—Machine tool man with from $10,000 to $20,000 to take contract to build twenty-four well-known lathes per month for five years; drawings, patterns, gigs, templates and special tools are furnished; straight selling. Address Box 141, AMER. MACHINIST.

Institutions retiring from business having machine tools, brass or wood working machinery, will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wanted—One 30 or 32 in. engine lathe, second-hand; one 12 or 14 in. engine lathe, second-hand; one 18 in. shaper, second hand; one medium upright drill, second-hand; one small sensitive drill, second-hand; must be cheap and in good condition. Address American Specialty Enameling Co., Johnstown, Pa.

FOR SALE.

Valuable Patents in the Machinery Line.

Number already sold. Best of testimonials. Will place on royalty with good party. Address

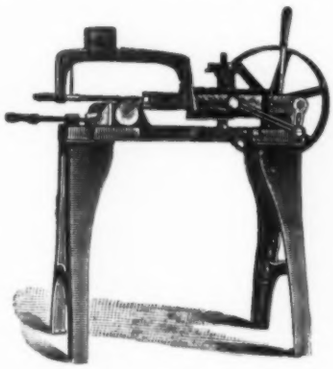
WALTER KENNARD,
917 Society for Savings Building,
CLEVELAND, OHIO.

"The best is as good as any."

The New

Automatic and Gravity Feed

Q & C Shop Saw



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Price—'Way Down.

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Shop Saws,

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For All Purposes.

Send for Catalogue.

Q & C Company,

Chicago. New York.

LONDON: Chas. Churchill & Co.
PARIS: Hounsfield & Fils.
BERLIN: Schuchardt & Schutte.
MADRID: J. G. Neville & Co.

(*Continued from page 35.*)

cuperation from the early part of this year than from last, for 1897 was not a bad year. In exports, however, there has been a remarkable increase over last year, roughly estimated to be more than a doubling in volume. Prices are tending lower, rather than higher, for the present policy of the company is to withstand the growing competition it encounters by smaller figures, rendered possible by decreased cost of production. A demand for power presses at present is coming quite heavily from tin plate working establishments.

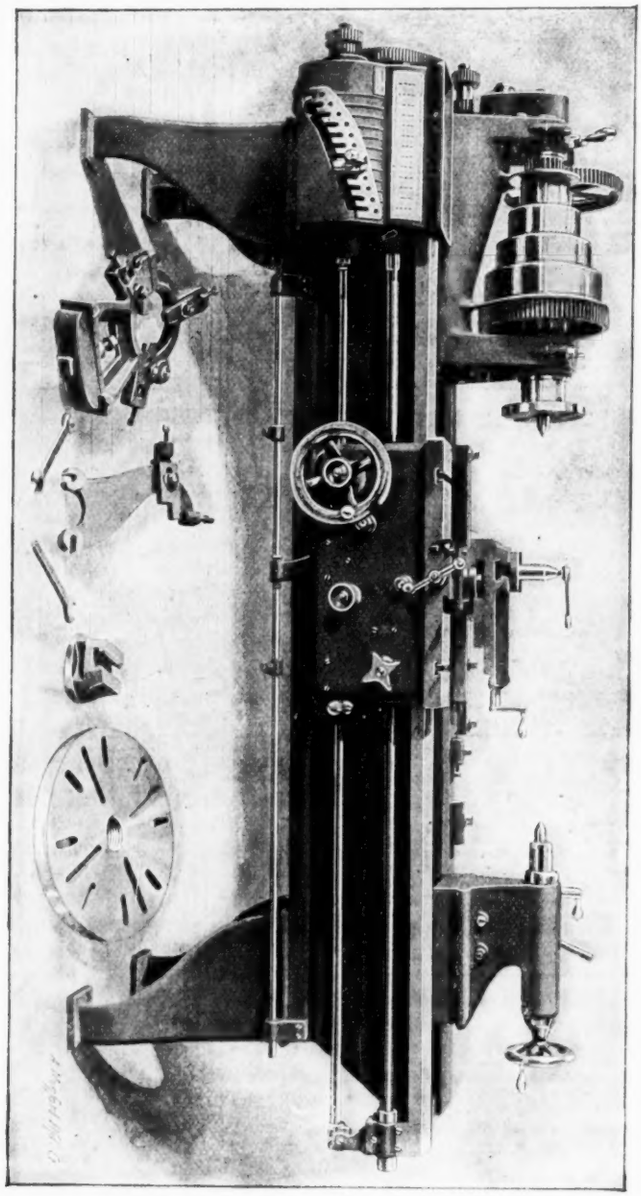
Following the buying out of the T. & B. Tool Company by the Morse Twist Drill & Machine Company, the plant of the former will be moved from Danbury to New Bedford, and the machinery is being packed for that purpose.

A machinery house in this city has received an inquiry for several lathes, planers and drills, to be sent to Manila.

Krajewski, Pesant & Co., of this city, are the proprietors of a machine shop in Havana for the repair of marine, sugar and general machinery, together with iron, steel and brass foundries and a boiler manufactory. They are now materially enlarging their facilities, having already purchased a considerable quantity of machinery, etc., for their new shops.

The Pratt & Whitney Company, of Hartford, Conn., has recently furnished, through their British agents, Messrs. Buck & Hickman, a bicycle plant to the value of about $70,000 to the Yorkshire County Cycle Company, of Leeds, England, which company intends to turn out first-class bicycles on a large scale, and to sell them to our English cousins as low as £10 each. The factory contains 27,715 square yards of flooring, and was once a flax mill, the machinery of which was afterward taken out and brought to America. The factory remained idle for some five years until the present company bought the property early this year, and, having fitted it throughout with machinery, now intends to manufacture bicycles. Mr. H. M. Cocksedge, the general manager, stated recently that the order was given to the Pratt & Whitney Company for the simple reason that the English firms applied to wanted to furnish what they thought the cycle company ought to have, instead of what was asked for. The company is backed by one of the largest clothing manufacturers in England, who has clothing stores in all the principal cities and towns in England, and it is the intention to handle the bicycles in connection with the regular clothing trade, thus saving the profits that would otherwise go into the pockets of middlemen. This company will also manufacture their own tires, they being the first of the cycle builders in England to undertake this venture. In closing the contract with the Pratt & Whitney Company

20 in. x 8 ft. Hendey-Norton Lathe.



ALL these Lathes have the Norton Screw Cutting feature. All the different threads and feeds in daily use obtained by moving the handle in gear box from one notch to the other. All sizes but the 32 in. fitted with our Automatic Stop Rod for carriage. By its use you can cut threads to and from shoulders and always have the carriage stop in the same place. All lathes have the reverse motion in head, operated by lever at side of apron. By this you reverse the carriage only, which is all that is necessary in cutting threads.

These attachments mean a great saving of time and labor.

THE HENDEY MACHINE CO.,

Torrington, Conn.

AGENTS FOR THE PACIFIC COAST:

PACIFIC TOOL AND SUPPLY CO., . San Francisco, Cal.
J. W. CREGAR, . . Philadelphia Bourse Exhibition.

EUROPEAN AGENTS:

SCHUCHARDT & SCHUTTE, Berlin, Vienna, Brussels.
CHAS. CHURCHILL & CO., Ltd., London and Birmingham, England.
ADOLPHE JANSSENS, ... Paris, France.

for this plant, the cycle company secured the option of duplicating this plant within a year at the same price, and since receiving the original plant have placed orders duplicating all the cutting tools, which in themselves are quite a satisfactory order. Among the tools in the equipment are hub-forming machines, automatic screw machines, Lincoln type milling machines, drilling machines with multi-spindles, turret-head screw machines, rapid power presses and cup and cone grinding machinery. During the past two or three years the business of the Pratt & Whitney Company in Great Britain has steadily increased until now it is a well-established trade, and machines to the value of thousands of dollars are shipped every month.

The loss of Mr. E. W. Irwin by the Pratt & Whitney Company as their New York manager will be viewed with regret by his many friends, if it means that he intends to leave this city. We trust that his plans for the future, of which announcement is, we understand, likely to be made shortly, involve his remaining in the New York machinery market.

The machine shops of Providence, R. I., and vicinity are fully employed, and some report their chief difficulties to lie in the direction of deliveries with the promptness necessary to accommodate old customers. Others complain of a scarcity of labor. The Brown & Sharpe Manufacturing Company reports a decided increase in the demand from domestic sources during the past six months. A recently organized concern is the Potter & Johnston Company, of Pawtucket, which is putting out a line of specialties in machine tools.

CHICAGO MACHINERY MARKET.

The closing days of the year are quiet, but the common comment of the machinery trade has been that the month just ending has been far more active than December for several years past. The last ten days of the month were not wholly without business, as has been usual. Notwithstanding the general disposition to crowd off pending transactions until the new year, scattering orders have been coming in. Machine shops throughout the West are busy, and when a new tool is needed it is often needed badly. Even a week's delay makes a difference.

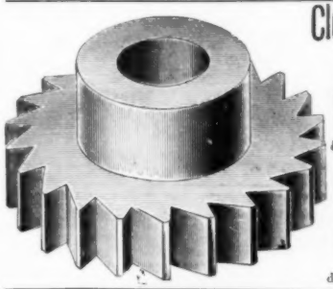
If orders during the past month had been assorted and classified it would have been found that the agricultural implement makers were among the best, if not the best, buyers. The shops that look to the farmers' trade are now employing more men than ever before. Their season of production may be said to be half gone, but they are putting on more steam, crowding in a few more tools and adding a few more machinists on their payrolls. They are running the shops on the hypothesis that they will sell more imple-

(*Continued on page 38.*)

Frasse Non-Corrosive Soldering Fluid,

Never rusts most delicate instruments and insures tight joints. Cheaper and 50 per cent. better than acid. No fumes. Warranted satisfactory or money refunded. Send 35 cents for full size bottle, post paid. Illustrated List 834 of tool, bargains, showing how you can save up to 50 per cent. on all the tools you use, mailed free.

THE FRASSE CO., 17 Warren Street, NEW YORK.



Cleveland Gear Works,
86 Seneca St.,
Cleveland, Ohio.
GEARS of all descriptions.

The **CROSS OIL FILTER**

actually reduces oil bills 50% or more. Sent on approval. Capacities 3 to 120 gals. per day. Used in 18 countries. Testimonials from the leading firms in every field of industry.

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AKRON, OHIO, U. S. A.
Business Established 8 Years.
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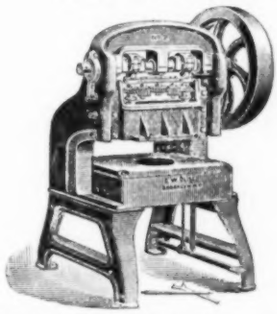

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Devoted to Motor Vehicles (Horseless Carriages)
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Illus. Catalogue of American Motor Carriages
52 pages; 60 cuts; price 25 cts.; no postage stamps.
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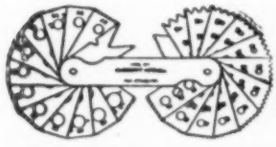
AN IMPORTANT GERMAN MACHINERY MANUFACTORY,

working with about 600 hands and employing the best modern tools, is open to undertake the building of specialties suitable for the German market, and would be willing to increase its staff by 400 to 500 hands. Specially capable for the best standard styles of machinery and possesses the highest reputation in the trade for first-class workmanship. Address F. R. 074, AMERICAN MACHINIST, 218 William Street, New York.



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Comb, twist drill, thread pitch, centre and top drill gauge.
Price, $1.50 each.
Gauge and 510 page catalog sent postpaid for $1.60; catalog alone for 25c.
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WE CLAIM THE FOLLOWING MERITS FOR **JENKINS BROS.' VALVES.**

1. Manufactured of the best Steam Metal.
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3. Contain JENKINS DISC, which is suitable for all Pressures of Steam, Oil and Acids.
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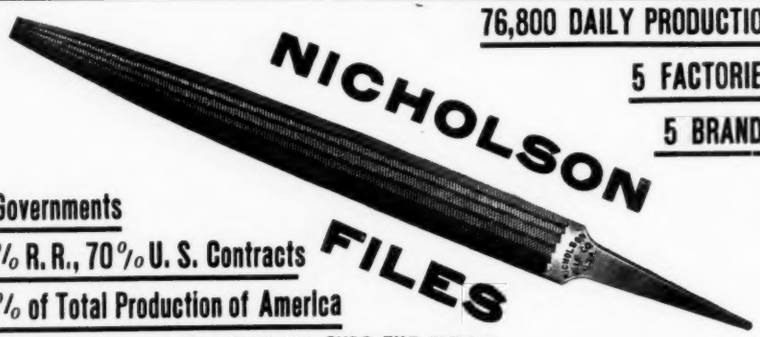
THE MECHANICAL ENGINEER'S POCKET-BOOK. Fourth Edition, Revised. Now Ready.

A Reference Book of Rules, Tables, Data and Formulæ for the Use of Engineers, Mechanics and Students. By William Kent, A.M., M.E., Consulting Engineer, Member Amer. Soc'y Mechl. Engrs. and Amer. Inst. Mining Engrs. 12mo. Morocco. Upward of 1,100 pages. $5.00. Order through your bookseller, or copies will be forwarded postpaid by the publishers on the receipt of the retail price.

JOHN WILEY & SONS, 53 East 10th Street, New York City.



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ROBT. KOLBE,
St. Petersburg, Moscow, Warsaw, Charkoff,
Contractor to the Russian Government—
will be glad to receive from best makers details of machinery of every description, especially of Tool Working Machines.
Agencies in all parts of the Russian Empire; also in Siberia.
Central Offices, . ST. PETERSBURG.

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FOR ALL PURPOSES.

MODEL '98 BICYCLE WRENCH.

Bicycle Drop Forgings.
Drop Forging Plants.
Machinists' Tools.
THE BILLINGS & SPENCER CO., HARTFORD, CONN., U. S. A.

Catalog B
just issued, describing full line of Screw Cutting Tools for Bicycle Repairers. Send for it.
S. W. Card Manufacturing Company, Mansfield, Mass., U. S. A.

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Coal Handling Machinery,
HOISTING ENGINES,
"INDUSTRIAL" RAILWAYS,
"STEVEDORE" ROPE, ETC.
Address the Works:
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SCREW-CUTTING
CENTRE, DEPTH, ANGLE,
AND TWIST DRILL GAGE
J. WYKE & CO. E. Boston Mass. U.S.A.
MFR'S FINE MACHINISTS TOOLS.
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"MONARCH" RIVETLESS LEATHER BELTING.
Write for Catalog "A."

ELECTRIC MOTORS
Manufacturers of the STANDARD ELECTRICAL APPARATUS of the World
To Drive Your Machinery and Tools?
GENERAL ELECTRIC COMPANY,
SCHENECTADY, N. Y.
Sales offices in all large cities of the United States.

(*Continued from page 37.*)

ments during 1899 than any twelve months in their history.

Some tool builders are looking to the horseless carriage as a promising development for the marketing of their products. There are in the West several inventors and prospective manufacturing companies inquiring about machinery in a tentative sort of way, and one manufacturer of this kind has placed a small order for tools. The beet sugar industry has also within it the earnest of coming possibilities. If hopes are realized, and the Western farmer succeeds in raising his own sugar, engine builders will be substantially benefited, and, to a more limited degree perhaps, the machinery men also. There is talk of the erection of several sugar-making plants in territory contiguous to this city.

Additions are still being planned and built to existing plants, for the rush of activity in iron and steel, both in crude and in finished products, is crowding producing capacities to their limits. Prices are stronger and the influences of the holiday dullness are on the whole scarcely more than nominal.

The two machinery stocks of the J. A. Fay & Egan Company and Manning, Maxwell & Moore, in this city, have now been united, and the latter firm has removed from 60 South Canal street to 22, 24 and 26 South Canal street, where the purchased stock of the J. A. Fay & Egan Company was located. Alfred J. Babcock, who has been with the latter company, is now manager at Chicago for Manning, Maxwell & Moore.

Among recent sales of J. B. Doan & Co. were the machinery for the extension of the Chicago Shipbuilding Company's plant in South Chicago; for the Norton Brothers shops at Maywood, Ill.; the equipment of a new electrical manufacturing company at Fort Wayne, Ind., and a large part of the second order of the Rock Island Arsenal.

▲ ▲ ▲

Quotations.

NEW YORK, Tuesday, Dec. 27.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$12 00 @ 12 25
No. 2 foundry, Northern	11 50 @ 11 75
No. 2 plain, Northern	11 00 @ 11 25
Gray forge, Northern	10 25 @ 10 75
No. 1 foundry, Southern	11 50 @ 11 75
No. 2 foundry, Southern	11 25 @ 11 50
No. 3 foundry, Southern	10 75 @ 11 00
No. 1 soft, Southern	11 50 @ 11 75
No. 2 soft, Southern	11 25 @ 11 50
Foundry, forge, Southern	10 25 @ 10 50

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.07½ @ 1.12½c.; refined, 1.15 @ 1.25c. Store prices: Common, 1.30 @ 1.35c.; refined, 1.35 @ 1.50c.

Tool Steel—Base Sizes—Standard quality, 6 @ 7c., with lower prices on some brands; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.45 @ 1.55c.

Cold Rolled Steel Shafting—Base sizes, from store in small lots, 2.25c. and upward.

Copper—Carload lots, Lake Superior ingot, 12⅞ @ 13c.; electrolytic, 12⅝ @ 12¾c.; casting copper, 12⅜ @ 12⅝c.

Pig Lead—Carload lots, 3.82½ @ 3.85c., f. o. b. New York.

Pig Tin—For 5 and 10 ton lots, 18.40 @ 18.50c., f. o. b.

Spelter—In carload lots, 5.00 @ 5.05c., New York delivery.

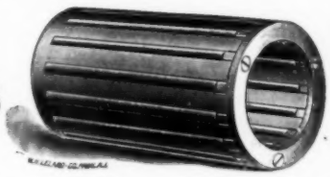
Antimony—In cask lots, 8.70 @ 9.25c., according to brand.

Lard Oil—Prime city, present make, the leading brand quoted at 45 @ 47c., in wholesale lots. Some brands may be obtainable at 1 @ 2c. less.

LAST YEAR —— we sold

More Roller Bearings

than ever before



All up-to-date Rolling Mills are equipped with **Mossberg Roller Bearings,** which are the **only bearings** which **give satisfaction** on this class of **machinery.**

Manufacturers of all kinds of **machinery are calling for them. Our Government** is using them by the thousand.

Write and get our prices for 1899.

Mossberg & Granville Mfg. Co.,

PROVIDENCE, R. I. **New York Office, 126 Liberty St.**

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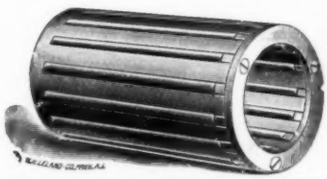
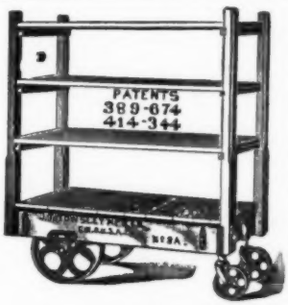


McDowell, Stocker & Co., 61 South Canal St., Chicago, Ill.
Chandler & Farquhar, 36 Federal St., Boston, Mass.
U. Baird Machinery Co., Pittsburg, Pa.
E. A. Kinsey Co., Cincinnati, Ohio.
Kowalewski & Ruesch, 44 Green St., Newark, N. J.
Foreign Agents: Charles Churchill & Co., Ltd., London and Birmingham, England.
Adolphe Janssens, 16 Place de la Republique, Paris, France.
A. Mathey-Doret, La Chaux-de-Fonds, Switzerland.
De Fries & Co., Dusseldorf and Berlin, Germany, Vienna, Austria.



Assembling Trucks for Machine Shops, made with Platform and one, two, three or four shelves, 2 x 4 feet. Saves time, money and space.

J. T. TOWSLEY MFG. CO.,
518 Main Street, Cincinnati, Ohio.

"The Reeves" Wood Split Pulley,

with interchangeable bushing system for belt power transmission.

Lighter than an iron pulley. Stronger than a steel pulley. Each pulley will fit thirty-five sizes of shaft. No set screws. No keyway. Complete stocks carried in every jobbing centre in the United States. Also

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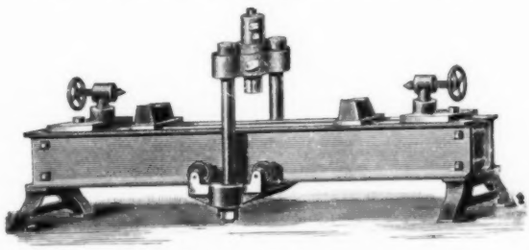
WEITZ, CHILD & BENEY, Vienna, Austria.

Reeves Pulley Co., Columbus, Ind., U. S. A.,
Send for Catalogue. **Manufacturers.**

You can straighten 'em out



with this Straightening Press in almost no time. Saves lots of time and trouble.

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Selig, Sonnenthal & Co., London.

Green River Patent Spiral Fluted Reamers.

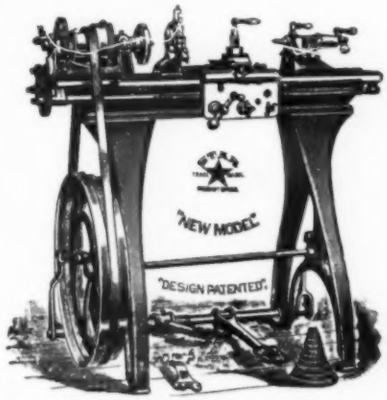
These Reamers will not draw themselves into the work, will not chatter, cannot cut under the true surface, cannot be forced, always make a perfect hole, and do not have to be specially ground for brass or other soft metals. Made in 77 sizes, ranging from ¼ inch to 5 inches. Red Catalogue free.

Wiley & Russell Mfg. Co., *Greenfield, Mass., U. S. A.*

Selig, Sonnenthal & Co., 85 Queen Victoria Street, London.

Star Foot Power Lathes

9 and 11 Inch Swing.



Screw Cutting Engine Lathes with Automatic Cross Feed, with or without Compound Rest, Friction Countershaft, etc. Contain new and original features especially adapted for Bicycle, Electrical and Accurate Machine Shop Service.

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Whitney Wood-Working Machinery.

Whitney's works have been in operation under the same management for sixty years. For sixty years nothing but the best of tools have ever left Whitney's shop. Ask anyone. New book is ready.

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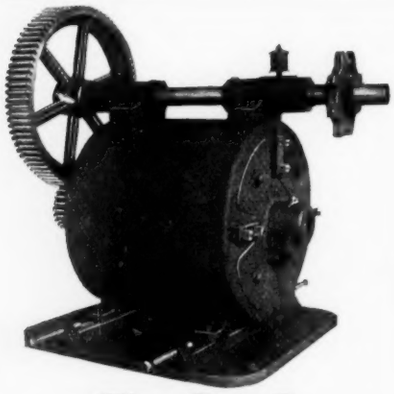

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Back-Geared Ironclad Motor

Is unsurpassed for connection with machinery, machine tools, etc., where a considerable speed reduction is required, and with little loss.

Write us for further particulars.

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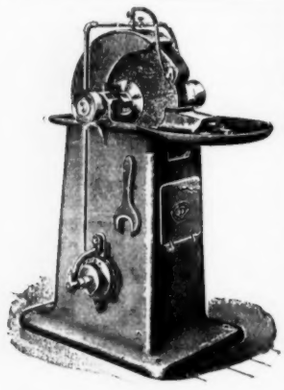
CHICAGO, ILL., 1012 Monadnock Block.
PHILADELPHIA, PA., 633 Arch Street.
LONDON, ENGLAND, 47 Victoria Street, S. W., Westminster.



Water Tool Grinders

in five sizes, to take wheels 14 in., 20 in., 24 in., 30 in. and 36 in. in diameter. These machines are the result of many years' experience in making this class of tools.

Write us for prices.

Diamond Machine Co.

PROVIDENCE, R. I.; CHICAGO, ILL., U. S. A.

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For Advertisement of

Morse, Williams & Co., Philadelphia, Pa.

See Issue December 22, 1898.

NEW PROCESS RAW HIDE PINIONS

For Electric Motors and all High Speed Machinery.

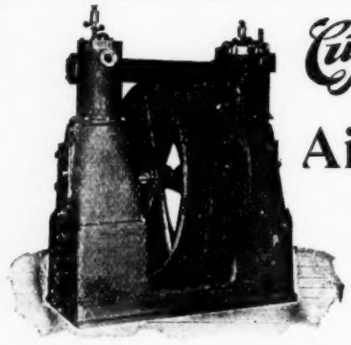
NOISELESS, CLEANLY, DURABLE.

New Process Raw Hide Bushings.

THE NEW PROCESS RAW HIDE CO.,

Patentees and Sole Manufacturers,

SYRACUSE, N. Y., U. S. A.



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Make Air Compressors for use with Pneumatic Hammers, Drills, Hoists, Pumps, etc., and for general use in shops, foundries, shipyards and kindred plants.

Air Compressors

built by us are of the highest grade, combining simplicity of design and maximum capacity. We shall be pleased to send you all particulars on request.

Agents: Walter H. Foster, 126 Liberty St., New York.
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The Fastest Boat in the Navy.

The Torpedo Boat Destroyer Farragut on her official trial steams over thirty knots.
The Engine Forgings and Shafting for this boat were manufactured by

The Bethlehem Iron Company,

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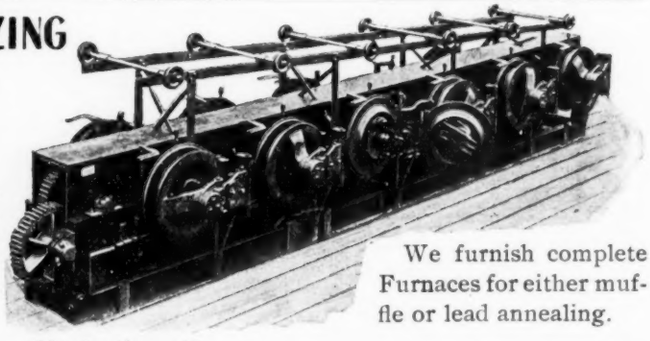
Patented sheaves and fittings.

The outer sheave opens on a knuckle joint, allowing the bundle to be dropped to the floor without lowering the sheave.



We furnish complete Furnaces for either muffle or lead annealing.

(See last week's advertisement.)

The Turner, Vaughn & Taylor Co., Cuyahoga Falls, Ohio, U. S. A.

Cable Address: "Vaughan, Cuyhago Falls." A B C Code.

Builders of complete outfits for Wire, Wire Nail and Chain Factories.

WHY DO YOU SUPPOSE WE HAVE TWO LARGE WAREHOUSES OF STOCK?

MACHINE TOOLS OF ALL THE VERY BEST MAKES.

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Maris Bros., Philadelphia,

are makers of Cranes, Overhead Track Systems, Turntables, Switches, Trolleys, Portable Hoists, Etc. Cranes for machine shops, electric lighting plants, foundries and other shops, in all sizes up to 30 tons, in spans of from 20 to 70 feet. Particulars on request.

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Expert Testing. Estimates. Designer of Electrical Lighting Plants. Specialty: Electrical Equipment for Shops, Factories, Tanneries, etc.

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Consulting and Contracting Engineer. Brass and Copper Rolling Mills, Seamless Tube Plants, Rod and Wire Mills, Power Transmission Machinery.

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Special Machinery designed and contracted for. (Care of The Century Machine Co.),

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Designer of machine tools for special purposes where economy of output is desired.

Agent for the Windsor Screw Machine.

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3,200 Sizes, *Spiral, Worm,* Rack, Elliptic, etc. Send for catalog.

BEVEL GEARS

with perfect planed teeth.

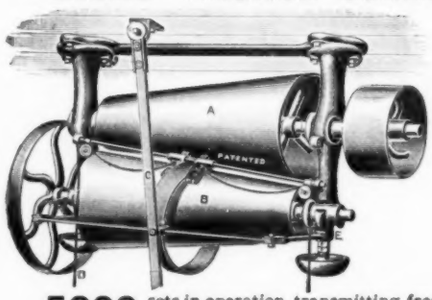
HINDLEY AND ALBRO

Worm Gearing.

Consumes less power and gives better results than the old style worm gearing.

Albro-Clem Elevator Co., Philadelphia, Pa., U. S. A.

EVANS FRICTION CONES.



5000 sets in operation, transmitting from one to forty horse-power. Send to **G. F. EVANS, 85 Water Street, Boston, Mass.,** for illustrated catalogue.

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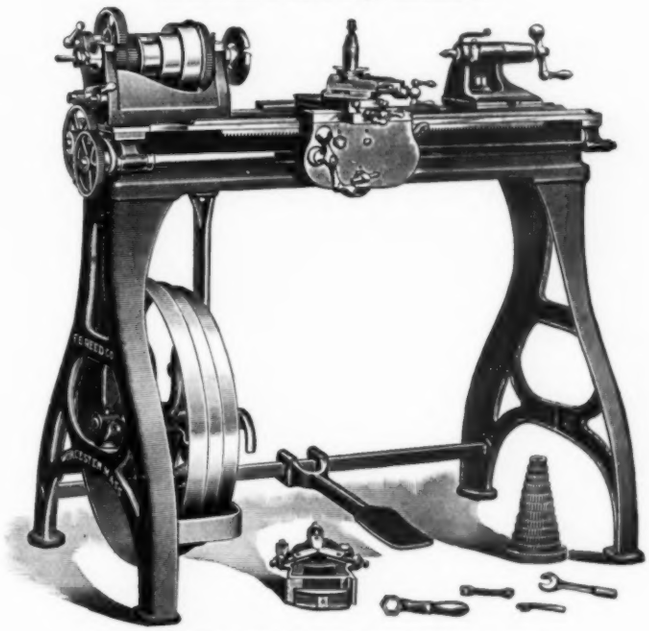


10-INCH SWING SCREW CUTTING FOOT LATHE.

A thoroughly well made screw cutting Lathe, for either foot or steam power. Price low considering value. Sold through agencies in New York, Philadelphia, Boston, Providence, Baltimore, Syracuse, Pittsburg, Cleveland, Chicago, San Francisco, Detroit; also in London, Paris, Berlin, Brussels, Rotterdam and Moscow; or direct from the factory. Full particulars and price on application.

HAVE YOU EVER INVESTIGATED

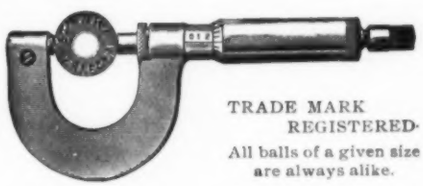
The New Radial Drills

Built by DRESES, MUELLER & CO., Cincinnati, Ohio ?

WRITE FOR DESCRIPTIVE CATALOGUE.

You Are Wasting Money

If you are using imperfect balls after perfecting your cups and cones.



We Guarantee that every ball we make is **a perfect sphere.** That every ball is within $\frac{1}{10,000}$ **of an inch** of exact size.

TRADE MARK REGISTERED.

All balls of a given size are always alike.

The Steel Ball Co.,

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AIR COMPRESSORS Mines, Machine Shops, Factories, Pneumatic, Tools, Etc.

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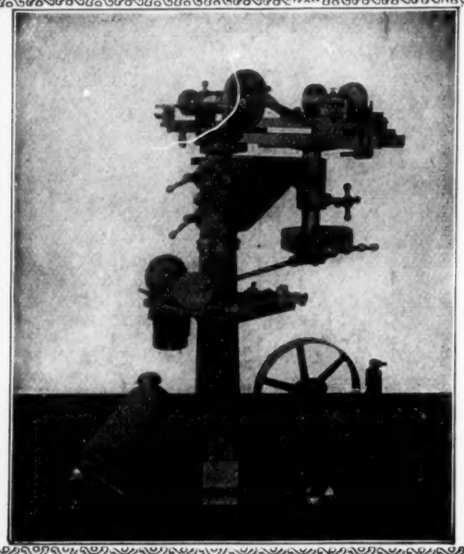
Cheapest Power Known.

FOR CIRCULAR ADDRESS

BACKUS WATER MOTOR CO., NEWARK, N. J., U. S. A.



A Complete Grinder.

This Universal Grinder will not only grind all kinds of cutters and reamers quickly and accurately and correct in form, but is successfully used for circular and surface grinding on a large variety of work. A pamphlet telling about it mailed free. Will you have it?

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Steel, 150 per day.

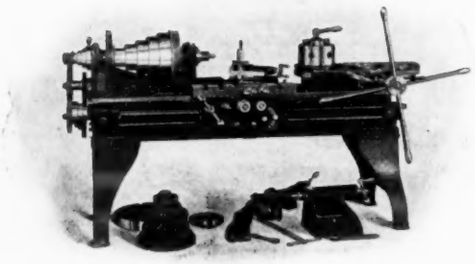
Brass, 600 per day.

Day after day the Spencer Automatic Screw Machine is turning out duplicate work similar in character to that shown above, and doing it accurately and rapidly with but very little attention, one man only being needed for several machines. The Spencer Book gives all details. Free on request.

The Spencer Automatic Machine Screw Co.,

HARTFORD, CONN., U. S. A.

The "SPRINGFIELD" Engine Lathe with Turret



This is our regular Engine Lathe fitted with a turret in place of a tailstock. If desired a tailstock is also furnished, thus giving you the advantage of both styles of lathe. The turrets are made to revolve either automatically or by hand and with or without power feed. The feed for turret is driven independently from carriage feed, so that *both* may operate with feed best adapted to the work in hand. Arranged to give three changes of feed for turret without changing belt.

The Springfield Machine Tool Co., Springfield, Ohio, U. S. A.

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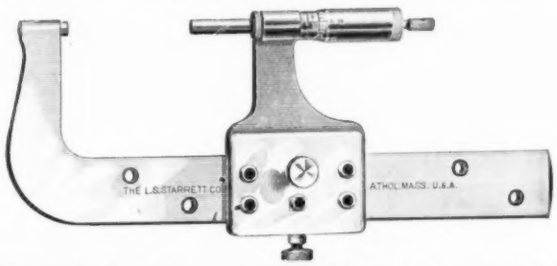
Builders of ENGINE AND TURRET LATHES, SHAPERS AND PRESSES. . .

STARRETT'S PATENT

6-INCH MICROMETER



This Micrometer will measure round work to 4¼ inches, and flat work to 6 inches. It weighs 21 ounces and is rigid and accurate. It can be quickly set to exact position, from 1 inch to 6 inches, by inserting a straight plug. A valuable feature of this tool is a set of six independent holes through both the movable part and the beam, each hole being bushed with hardened steel bushings, ground and lapped to fit the plug which locates to exactness the various inch settings.

Price in leatherette case, $21.50.

Catalogue of fine Mechanical Tools, Milling, Gear and other Cutters sent on request.

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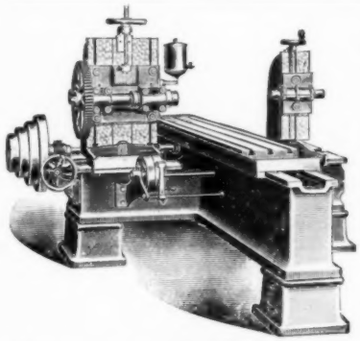
VIENNA—Schuchardt & Schütte, VII, Bez. Breitegasse, 17.
BUDAPEST—Székely & Káldur, Erzsébet-Korut 9-11.
LA CHAUX DE FONDS—W. Hummel Fils, 30 Rue Peopold, Robert.



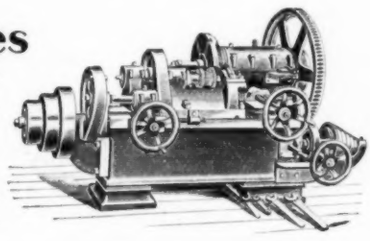
Power Milling Machines

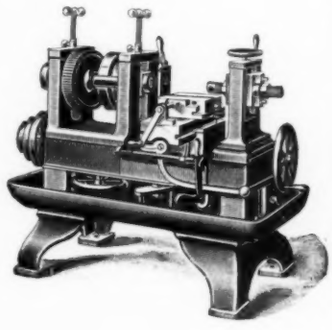
1894 MODEL.

Made in two sizes with *single head*, with footstock as shown in cut or without it, with *overhanging arm*, also with *two heads*. The *Tables* are driven by a large, powerful worm engaging with a rack screwed to table, and have automatic adjustable stop motion, also *patent adjustable stop mechanism* which allows the work to be run up to the cutters without breaking the teeth. Machines of similar style, made in two larger sizes, with table feed in either direction of travel.

Circular Milling Machines

For milling the peripheries and edges of gears, pulleys, etc., in straight, angular and curved lines, and for other work of a similar character. Nos. 0 and 1 machines are arranged for external and internal milling. No. 3 for external milling only. Are very stiff and powerful, and do their work four times as fast as is done by lathes, and produce a smooth surface.





Lincoln Milling Machine.

COLT'S MODEL, 1897.

With footstock, vise, pan and patent adjustable stop mechanism that prevent breakage of mill teeth when the work is run up to the cutters.

Column Milling Machines in four sizes.

GRANT Single and Double Head Milling Machines, Vertical Spindle Milling Machines, Milling Cutters, Milling Machine Vises and Centers

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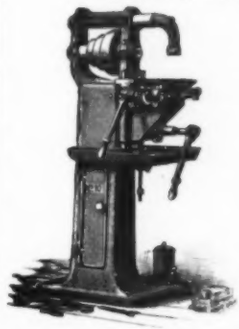
Kempsmith Machine Tool Co.

Milwaukee, Wis., U. S. A.,



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What makes price so low? you ask. Modern shop, modern facilities, up-to-date management. That is the combination that regulates our price.

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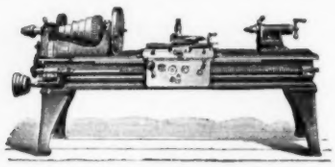

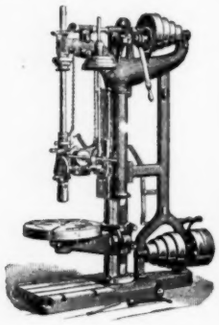

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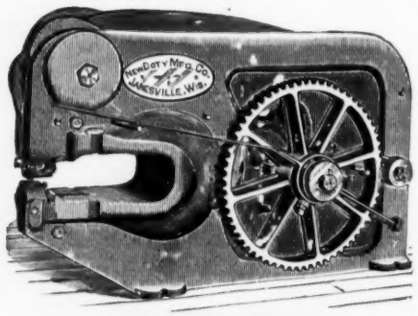

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Punches and Shears,
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Steam and Gas Fitters' Hand Tools,

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Send for Circular.

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Wrought Iron Shaft Forging-Machine 30 inch Lathe. Diameter in rough 14 11/16 inches, reduced in one cut to 14 1/16 inches. Feed 20 revolutions to 3 inches, or 15/100 inch per revolution. Length, 94 inches. Cutting speed. 28 feet 9 inches per minute. **Weight of chips, 289 pounds. Condition of tool apparently as good as at beginning of cut. Time, 83½ minutes.**

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Cold Saw Cutting-off Machines,
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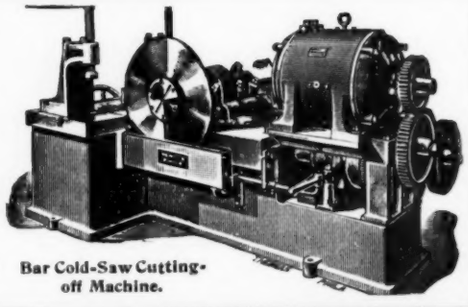
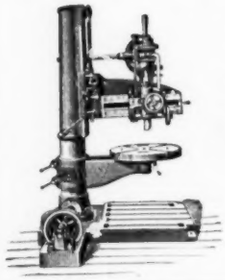


Bar Cold-Saw Cutting-off Machine.

One Lever



controls the whole action. Starting, stopping, reversing, engaging and disengaging back gears. Gang's Radial Drills, made in two styles and five sizes.

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We make drills from one to eight spindles, hand and automatic feed. Send for price of the

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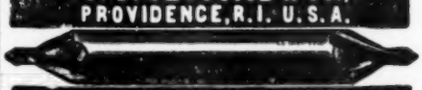

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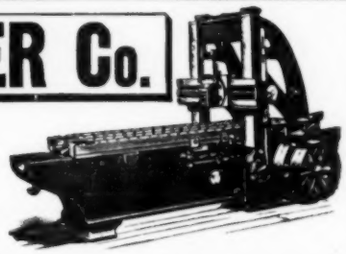

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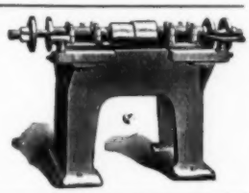
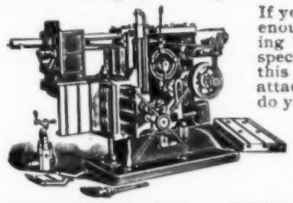


Morton's Draw Cut Shaper with Keyseating Attachment.



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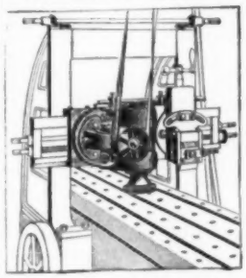

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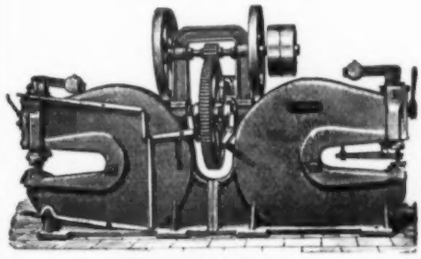

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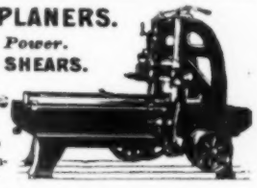

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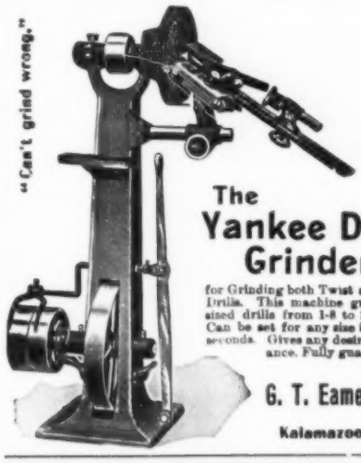

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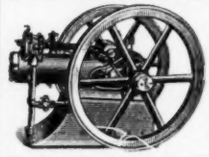

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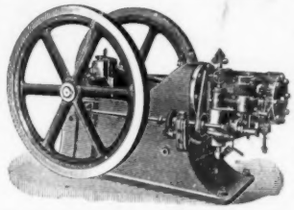
In Stock for Immediate Delivery!



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Compressed Air Self-Starting Device furnished with our large Engines—10 H. P. up.

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FOOS Gas and Gasoline Engines EXCEL ALL OTHERS IN DESIRABLE FEATURES.

Adapted for ALL Power Purposes—Electric Lighting, Milling, Mining Water Works, Elevators, Factories, Etc. Cheaper and Better than Steam.

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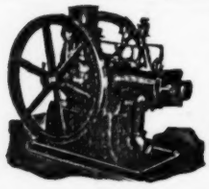

THE MIETZ & WEISS Gas and Kerosene Engine.

The cheapest power known.

One-half cent per horse power per hour. Simple and reliable. No valves. Patented 1896 and 1897 in all countries.

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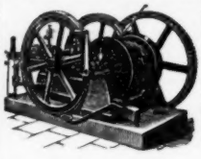

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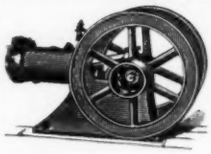

Stationary, ¼ to 20 H.P. Price, $60 and up.

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16, 18 and 20 foot Vapor Launches.

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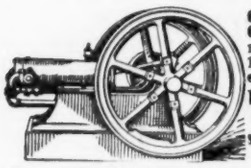

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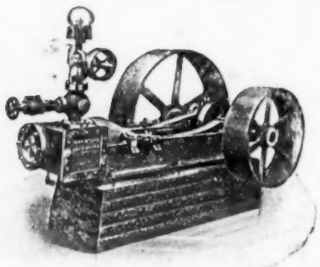

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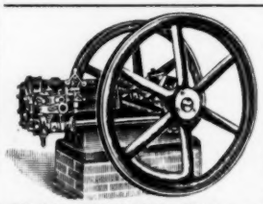

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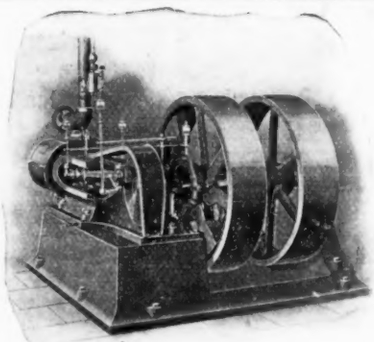

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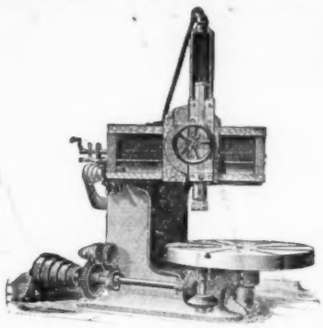

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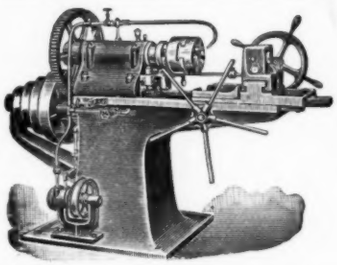

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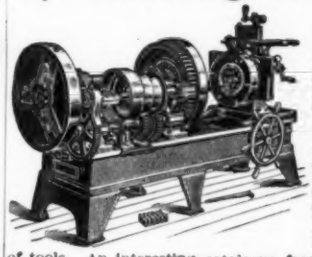

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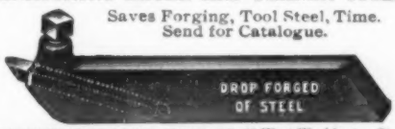

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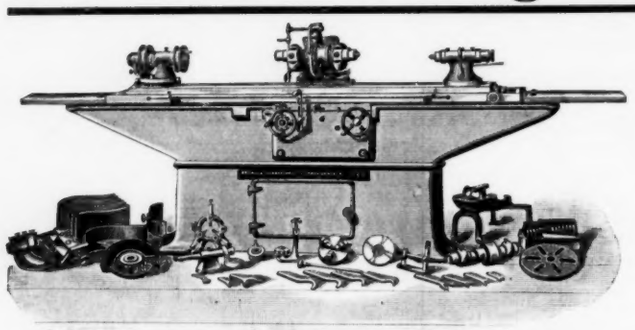

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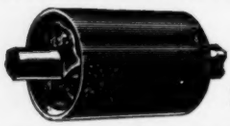

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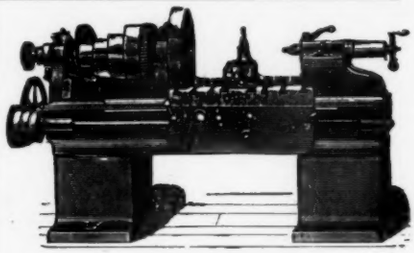

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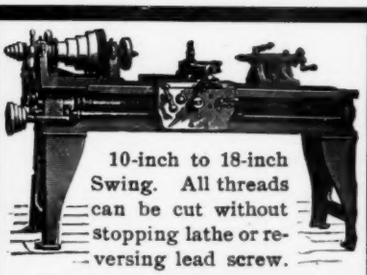

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